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VOLUME 41

IN THE SUPERIOR COURT,

State of California, County of Sacramento.

OCTOBER SESSION, 1881.

HON. JACKSON TEMPLE, - - - - - PRESIDING JUDGE.

WINFIELD J. DAVIS, OFFICIAL REPORTER.

SAMUEL OSBOURNE AND WILLIAM M. CUTTER, REPORTERS.

The People of the State of California,
vs.
The Gold Run Ditch and Mining Co.

COUNSEL:

For Plaintiff,

HON. A. L. HART, Attorney General, GEORGE CADWALADER, ISAAC S. BELCHER, A. L. RHODES, RICHARD BAYNE.

For Defendant,

J. K. BYRNE, W. C. BELCHER, S. M. WILSON, W. T. WALLACE, A. B. DIBBLE, A. P. CATLIN.

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In the ⁴¹ Superior Court
of the State of California
in and for the County of
Sacramento

The People of the State of California	} Afternoon Session Tuesday Jan'y 17 th 1882
vs. The Gold Run Ditch and Mining Company	

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Official Reporter

Afternoon Session.

Mr Belcher. Before the examination of the witness proceeds I would like to make an offer of certain matters from these reports of the State Board of Health.

Mr. Cadwalader. Do that some other time when my head is not quite so full of other figures. I will be through with this witness in a few ~~minutes~~^{moments}.
The Court. Proceed then.

Testimony of R.M. Randall.

Cross-examination resumed.

Mr. Cadwalader.

I at recess you were asked to mark the route you travelled?
 A. We came up; I think we came in closer to the land on this side ~~going~~^{going} up than we did coming down; I could not say exactly. Then coming down you see the marks.
 I What creek is that?

A. Petaluma Creek.

2. How many soundings did you take in Petaluma Creek?

A. 14 I think.

2. You made all your soundings on the north side of the Bay?

A. Yes.

The Court. Near the mouth?

A. This is Petaluma creek and this is Napa creek. I made soundings up that afterwards. That has not been brought out in the direct examination, only incidentally. I likewise made soundings up the Sacramento in the vicinity of Collinsville.

Mr. Cadwalader. All the soundings that you took were on mud flats?

A. No, they were not. I have the depth marked.

2. That is not what I ask you. I asked if all the soundings you took were not on mud flats.

A. We found nothing but mud and soft material.

2 Were not all your soundings taken on mud flats?

A. I do not know what you call mud flats. That is the line that we followed (pointing.) If you call that mud flats then they are mud flats.

2. You have indicated your route, have you?

A. Yes; route.

2. On the north side of the bay?

A. Yes.

2. Five-sixths of your soundings were taken either in Retaluma creek or within a mile or two of the mouth.

A. Not, in the deepest water.

2. What is your formula for determining the discharge from a six inch nozzle under a 375 foot pressure?

A. It would be the square root of the head. It would be the square root of 29 times the head multiplied by .95.

2. What is the discharge of a six inch nozzle under the 375 feet pressure? Give it to

us approximately. That is what I want.

A. I can save the trouble of working that up <producing book.>

2. Never mind about what your book says?

A. It will save the trouble of figuring it up.

Mr. Dibble. Figure it up and give it exactly.

Mr. Cadwalader. Is that going to take you long?

The Witness. Yes, it is a long problem.

2. Well you can calculate that after you go off the stand, if there is no objection on the other side, and hand it in with your other calculation. Is there any objection to that?

Mr. Dibble. No sir. Let it go in as evidence in the case.

Mr. Cadwalader. Can you approximate to it before making your estimate?

A. No. I can tell you what you have to do to obtain the result. You have to take the square root of 28,375 and then multiply that by $\frac{95}{75}$ and that gives the

velocity. You multiply that by .95 and that accounts for the friction in passing through the pipe. It is very nearly the theoretical velocity in passing through the pipe.

2. Do you know what the discharge approximately is?

A. No. I do not carry those things in mind.

2. What is the discharge through a four inch pipe under a head of 125 feet?

A. I have not the calculation. I have it through a five inch pipe; because I made that calculation.

2. Well, approximately? If anybody should ask you what a French pipe with a French nozzle would discharge under 125 feet pressure, what would you answer?

A. Well, it would make a long problem. I do not hold those things in mind. But it is a matter of simplicity to make the calculation. It is no more difficulty than addition.

Q. Would it not be 400 inches?

A. Not as much as that I think.

Q. Would it not be 364 inches?

A. I think not.

Q. Do you know?

A. I think not.

Q. According to your own tables?

A. If my tables say so I would prefer the tables of course. I made those with great care.

Q. Do you know what your own tables say?

A. I do not. I do not recollect it. I do not carry it in mind any more than I would carry a set of books or ledgers in my mind.

Q. Now, I will read this from Geology by Le Conte, edition of 1881: "Let A represent a cubic inch of stone which a current with a certain velocity will just move. Now the proposition is that if the velocity of current be doubled what kind of a stone will it move?"

A. Well, according to this paper it would move 64 times

as large. But I say that is not correct.

Q. Le Conte says it will move the stone V, 64 times as large. Mr. Belcher. That is theoretical. Mr. Cadwalader No.

The Witness. Yes, that is entirely theoretical.

Q. What would be the ~~present~~ opposing surface of the stone V, 64 times as large as the stone A, the stone A being one inch square? What be the difference in the opposing surfaces? Just tell me now.

A. I say it is not correct.

Q. But I ask you what is the difference between the opposing surfaces?

A. I say it is not correct in the book. If you wish me to make a calculation, I will make it.

A. If you wish me to make the calculation, I will tell you. I do not wish what that book says.

2. I am not saying that at all, but what is the difference between the opposing Surfaces?

A. Then I say I have to make the calculation. You must allow me to make the calculation if you desire it.

2. Is it not 16 times as great? A. No.

2. It is not? A. No.

2. De Corte says that from the fact that the opposing Surfaces of 1' and 16 times as large as of A. the moving force would be increased 16 times? A. I grant you that. But I demonstrated that same proposition to you this morning though in a different way, but coming at the same result and showing that the Conclusion rested entirely upon and was dependant

Entirely upon impact. Nothing more than impact was considered there as an element. I pointed it out to you in the report.

I <Int> That is not what I ask you —

A <Int> Goes on! Keep quiet and I will keep quiet to you. I pointed out to you there was the element of friction, that the stone had lost a portion of its weight by being immersed in water, that there was friction, that the greater stone had the more intense pressure. All of these elements De Conte had not considered in his attempted solution of that problem. He has simply solved one part of it, simply for the school room. And now allow me still farther —
The Court <Int> The question is what was the existing surface?

A That is what I say.

that they can not arrive at
the resisting surface. I
will now call the attention
of the Court and Counsel to
Page 20 50 of the Conte:

"The transporting power of water
must not be confounded with
its erosive power. The re-
sistance to be overcome in
the one case is weight, in the
other cohesion; the latter va-
ries as the square, the former
as the sixth power of the
velocity. In many cases
of removal, of slightly co-
hering material the resistance
is a mixture of these two
resistances and the power re-
moving the material will
vary at some rate, between
 v^2 and v^6 . So it would
even come down as close as
four rather than 64.

Mr Cadwalader My question
is this: When you double
the velocity how much do
you increase the power against
the stone

A If you will allow me a moment, I will solve that problem for you.

Q I will ask you whether the force is not four times as great? A One question at a time. I will solve it in a very few moments. It is simple, a very simple thing (figures) without carrying it to hundreds, carrying it as far as the first place in decimals, it would be nearly 2.4, which comes on the side of the cube it would make

Q I am not talking about that? A Certainly. You are asking me for the resisting surface and that is the side of the resisting surface.

Q But when you double the current? A .576 is the surface I understood you. You asked what was the resisting surface. It was .576

Q When you double the

Current what is the increase the force against every square inch of the stone?

A What is the force? It would be the square of the velocity divided by $2g$; that would be the impact force.

Q Is not that unbellyable?

A Not to a man who understands his business.

Q There are no decimals about it are there?

A I told you yes. I have given you the side of the square, I have given you the face, I have given you the cubic contents.

Q If the current is two miles an hour and you double it do you not simply increase the force four fold?

A Yes if you double it —

Q Int'y? Now you have the force increased 4 fold and you have the opposing surface increased 16 fold.

A But I object to that, and have explained to you

That it is not the sixth power. The sixth power in 'Cubes' would give 64 times and the square^{root} of 64 would be 8 times, which would be 4 inches of surface, provided I admitted it, but I do not admit it.

2 The carrying power increases more rapidly than the velocity does it not? A I told you it is as the $3\frac{3}{4}$ power

2. Now I will read the last passage from Le Conte:

"We may accept it therefore as a law that the transporting power varies as the sixth power of the velocity. If the velocity therefore be increased ten times, the transporting power is increased 1000000 of times."

A I know he says that, but what I pointed out to you and which is true —

I (Intj) When I gave you a current of 20 miles an hour you found that it

could only move a rock
20 times as large as could
a current of 2 miles an
hour. De Coute says it will
move a rock 1,000,000 times
as large. That the trans-
porting power is increased
a million of times?

A You gave one distance,
gave me a six ^{mile current} ~~ten~~, and
I gave a reply to that, that
it would be 25 miles on the
side. So you seem to make
a misstatement of fact there.

I will ask you this
question: What kind of a
rock will a current moving
at the water of 2 miles
an hour move or transport?

A I could have to go
through the calculation to
arrive at that exact. I will
give it at a 2.26, miles
current, by the Experiment
of Du Buat. It would move
a pebble as large as an Egg.
He does not say a Hen's
Egg, but I presume that Egg

ci' meant.

I suppose you increase the current to 10 miles an hour
 A. If you please let me finish.

I One moment. He have given what will transport a rock the size of a Hen's Egg?
 Mr Dibble By DuBoat.

Mr Cadwalader No! Not by DuBoat.

Mr Dibble Yes! he said by DuBoat.

Witness. Yes! I said by DuBoat.

Mr Cadwalader He did not say by DuBoat.

Mr Dibble He did say so, Witness I did say so.

Mr Cadwalader Whether he did or not has nothing to do with my question.

Now you increase the current to 10 miles an hour what kind of rock will it carry?

A Excuse me there a moment -

I [Intj] Just answer

my question. Answer ac -

According to DuRoiat or by
your own observation or
by any work you please

A Then I will make the
Calculation. If you wish
me to make it I will
do so. But I state this:
At 8 miles we have the
Actual Experiment; and that
it will not move
quarry rubble stone containing
 $\frac{1}{2}$ of a Cubic foot

I will ask you if, when
it is increased to 10 miles
an hour, it will not
carry rocks weighing $1\frac{1}{2}$
tons, and when 20 miles
an hour it will not carry
fragments of rock 100 tons
in weight.

A Now then I will make
the figures on that.

I do not ask you for
to make any figures.

A I can not carry those
things in mind. I have told
you what the Experimenters say
I My question is this:

Whether a current 10 miles
an hour, will or will not
move rocks weighing $1\frac{1}{2}$
tons? A I say no
it will not. I will tell you
what it will move.

2 I ask you if a current
of 20 miles an hour will not
carry with it fragments of
rock 100 tons in weight?

A A current of what rate?

2. 20 miles an hour?

A Will not carry fragments
100 —

2 Yes? A Well, that
easily might be true

Mr. Cadwalader The witness
Can take his time and sub-
mit these figures hereafter

The witness These are a little
tedious, not difficult, but
a little tedious. Without
carrying it to the decimal point
it would make a block 29 inches
Cubes

How much?

A 29 inches Cubes, the Cubic
Contents of which would be
25,720 Cubic inches

What would be the size
of the rock?

A That is what I tell
you, it would be 25,720 Cubic
inches. The side of which
would be 29 inches and a frac-
tion over

What would be the weight
of it? A That would
depend on its specific gravity

What was about the
specific gravity 2.5?

Well, 2, about 2.6 or
2.7 something like that -
over 2.5.

2 Now you say that if the current is 20 miles an hour it will carry rocks 29 inches in diameter. A Yes, and a little upward

2 And when it is 8 miles an hour -

A [Intj] It moves 828 cubic inches. An 8 Knot current or an 8 mile current.

2 How much comes a rock 29 inches square weigh - a cube?

A It would have no thickness if it were simply a square

2 A cube I said?

A You could not weigh a surface very well.

2 How much?

A I said that I could not very well weigh a surface. I will call it for quick reckoning - I will call it $2\frac{1}{2}$.

Mr Dibble These are substances moving on plane surfaces

Mr Lodalader No sir, that has nothing to do with the weight

11846

Mr Dibble It has something

to do with the witness, if not with you

Mr Cadwalader The weight of a stone, the weight of a 29 inch cube, you say that has something to do with the smoothness of the surface?

Or the weight of it?

Mr Cadwalader I do not attach enough importance to that to take the time to go into a calculation

Mr Dibble Why did you ask him the question if you did not want him to calculate and answer

Mr Cadwalader I supposed that our Engineer could answer that question.

Mr Dibble He will

Mr Cadwalader I move that the witness be allowed to submit this calculation as a part of his testimony hereafter.

The Witness I am pretty near through with it

Mr Dibble I have no objection to having it make a part

of the record, with that understanding you can proceed to some thing else, and these questions can be answered in writing and made a part of the record.

Q Don't it sometimes ^{in mountain torrents} happen that stones weighing several tons in diameter are taken down by the current by the action of the water and thrown up on the bank?

A I have never seen them thrown up there. I have seen very large boulders lying in the stream, in the bed.

Q Weighing hundreds of pounds have you not?

A How?

Q Hundreds of pounds
A Lying in the bed of the River

A Yes

Q Boulders. Have you ever seen great blocks of stone thrown up on the banks

A Never to know that they came from there. Never to

Know that they were thrown up there, but rather I supposed that they came down there.

Q Now turn to your profile of this Gulo Basin

A I can give you an answer to that question now. That you asked me a little while ago. it is 1062 pounds.

Q Is it not 1600 pounds?

A 1062 I make it unless I have made a mistake in my calculation.

Q Is it not 1600?

A No sir it is 1062.

Q Is it not 1600

A Yes if I have made no mistake of course I have calculated it hurriedly.

Q Take that profile in your hand. When did you verify that?

A Friday.

Q Last week. How long were you engaged in it?

A Friday and I made the calculation since. The verification would be -

Q You did not go out on the work?

A Yes I went over the whole line of the work

Q You measured the work?

A Yes

Q Between here and Davisville

A I did not go to Davisville

I went about 8 miles and a little upwards of that out. No I went seven miles and a little upwards of that

Q Did you have any instruments with you

A I had a measuring rod and a tape line

Q That is all

A Yes

Q Was there any water running out there

A No I did not see that there was any motion to the water, although there might be I did not see it

Q Did you measure every opening there?

A Yes the depth of every opening.

Q You make the Cross section discharge there about twice as much there as it is in the River?

A More than that Sir

Q What did you make it

A I make the Cross section of the River about 20,000 Square feet.

Q I am speaking of the discharge -

Mr Belcher (Interrupting) He is giving you the measurement and that would give you the discharge.

Mr Cadwalader There is a good deal of difference about it as to Velocities

A Velocities were not Calculated as I understood.

Q I understood you to say that the discharge through those openings were twice as much?

A No Sir.

Q During the last flood twice as much as in the River

A No sir I did not so state
 Q What did you say?

A I said the discharge through those was probably six or seven times as much - that the River was carrying from $\frac{1}{4}$ to $\frac{1}{8}$ and of course those openings carried the balance of the flood and what run over the Rails. The area of those openings is 120 008 square feet. 120 007.75 is the exact measurement.

Now then there is the distance that the water rose above the rails and that -

Q [Interrupting] You say there are 120 000 feet of openings there?

A Yes independent of the River. Outside of the River

Q And 20 000 in the River

A 20 000 in the River

Q That would be as 6 to one?

A And there is 40 000 foot down that flowed over the rails

1185-2 Q Did you mention that before

how did you get at that
to go that went over the
rails?

A Because we had the depths
and lengths.

Q You were not there at any
time during the flood of 1881?

A I was not

Q You do not know what the
current was there do you?

A Well only -

Q (Interrupting) I mean from
your own knowledge?

A Well only by the general
fall. It seems to have the
same fall as the River.

Q You did not take any
measurements did you. Did
you find anything in the
tules that would retard the
flow of water?

A Not directly in the tules
no sir.

Q Would not the tules them-
selves retard it

A Not but very little they
soon would be broken down
by the rapid current.

Q Suppose they do not break down at all?

A Then I suppose they would offer resistance.

Q How much. What say would a bed of tules 20 miles long and as wide as those openings offer?

A Well they might - probably they would retard it ten per cent.

Q How much would the resistance of a strong south easterly breeze offer?

A It would depend on how hard it was blowing.

Q It would check the current?

A To some extent.

Q How much resistance would a grade crossing a quarter of a mile above the Rail Road bridge offer - a grade extending clear across the basin and the tule, How much would that offer?

A You mean an embankment thrown across there?

11934/ Q Yes.

A I suppose that would stop it until it flowed over the top of it and then thereafter it would take up its velocity and go on.

Q It would depend upon how close it was to it?

A It would take up its velocity. It would rise a little higher over it that is all.

Q What effect would trees growing above the Rail Road bridge have upon the velocity there?

A That would depend upon their number and dimensions.

Q What effect would deposits of sand have in the bed of the tube?

A It would probably retard. I cannot say how much. It is merely conjecture, say nine per cent or ten per cent.

Q In estimating the flow of water you take all those things into consideration?

A I endeavor so to do.

11855 Q The wind and the tide and

the embankment and the trees?

A Provided the wind blows when we are making our observations and then we go down -

Q Interrupting! During the wind generally blows does it not from the south?

A Yes I think the prevailing wind is southerly not always however.

Q The waves would have a great deal to do with it would it not?

A It would if the wind was to the south and likewise if it was from the north.

Q The wind is from the south in that season of the year. They have to protect both sides of the embankment with stone?

A They do that yes

Q So you know what the current in the River is as compared with the current in the tides

A I do not know precisely

Q You do not?

A No sir

Q You calculated on the basis that the current in the tules are the same as in the River

A No sir I am well aware that the current in the River would be greater than it would in the tules on account of having a greater depth.

Q Now you say that the levees on the Sacramento River prevent the water from going into the tules?

A Yes they act as a guide

Q Is that not entirely incorrect

A No sir

Q Is it not true that during the flood of 1881 there was substantially no levees on that side of the River above the English break?

A There might have been breaks in the levee but it is not substantially true because they did act as far as they

remained they did act as guides.

Q Do you not know that there was a space of ten miles in which there was no levee at all and where there never has been any?

A Where?

Q From Fremont down for ten miles

A That would have no effect here after the water got to this point

Q You said a short time ago that the levee prevented that tule from filling up

A Yes I mean that now - I mean that - I mean to say -

Q [Interrupting] Is the bed of the tule any lower than the bed of the Sacramento River?

A No the Sacramento River is a trifle below but very little lower in one or two places that I noticed on this map.

11858 Q Now would ten miles of

broken levees be sufficient to afford the water of the Sacramento an exit into these tules.

A No sir because a large portion of it would go by that point and create a flood here below. If the water was high enough it would do it.

Q That is dodging the question I ask you whether a ten mile space without levees would be broad enough to allow the Sacramento to go into the tules?

A That would depend on the height, the depth of the water and the height of the bank of course.

Q You say that the levees guide the waters?

A Yes

Q The inference being that they guided it so that they could not get out of the channel?

11859 A Yes

Q But if there would be no levees there would be nothing to guide?

A I so stated. The idea is this, which I expressed in my direct examination: That where you see a current flowing with any rapidity you will find that it will pile up in the middle on account of the velocity, which seems to draw in the water from the outside and pile it up in the middle. You will notice that in the small streams, you will notice it in flumes.

Q You say that the water could not get out of the Sacramento River from lack of fall. Is not there plenty of fall in the tules?

A I coupled with that fall and outlet.

Q Is not the fall three times as great in the tules as it is in the Sacramento River

11860 A No sir

Q Do you know what the fall is in there

A They come out about together.

Q Do not the tules run on a tangent while the River circles around?

A A tangent to what curve sir.

Q Now you are speaking about
A (Interrupting) I said a tangent to what curve.

Q You were speaking of the American River being hindered in coming down stream what hindered it?

A What hindered what?

Q What hindered the American River from coming into the Sacramento River in a different angle?

A It is like this -

Q (Interrupting) No, but what hindered the American River from coming into the Sacramento River at a different angle?

11861 A Than formerly?

Q No, because I am speaking of the American River now?

A What hinders it?

Q What hinders it?

A It does get in there.

Q How?

A It does get in there.

Q Is it not because it is a sediment bearing stream and it makes a bar?

A No sir not altogether, that may have some little influence.

Q Would not that follow, is it not the bar that sends the American River straight over to the other bank?

A The bar sends it over.

Q Yes? A No sir

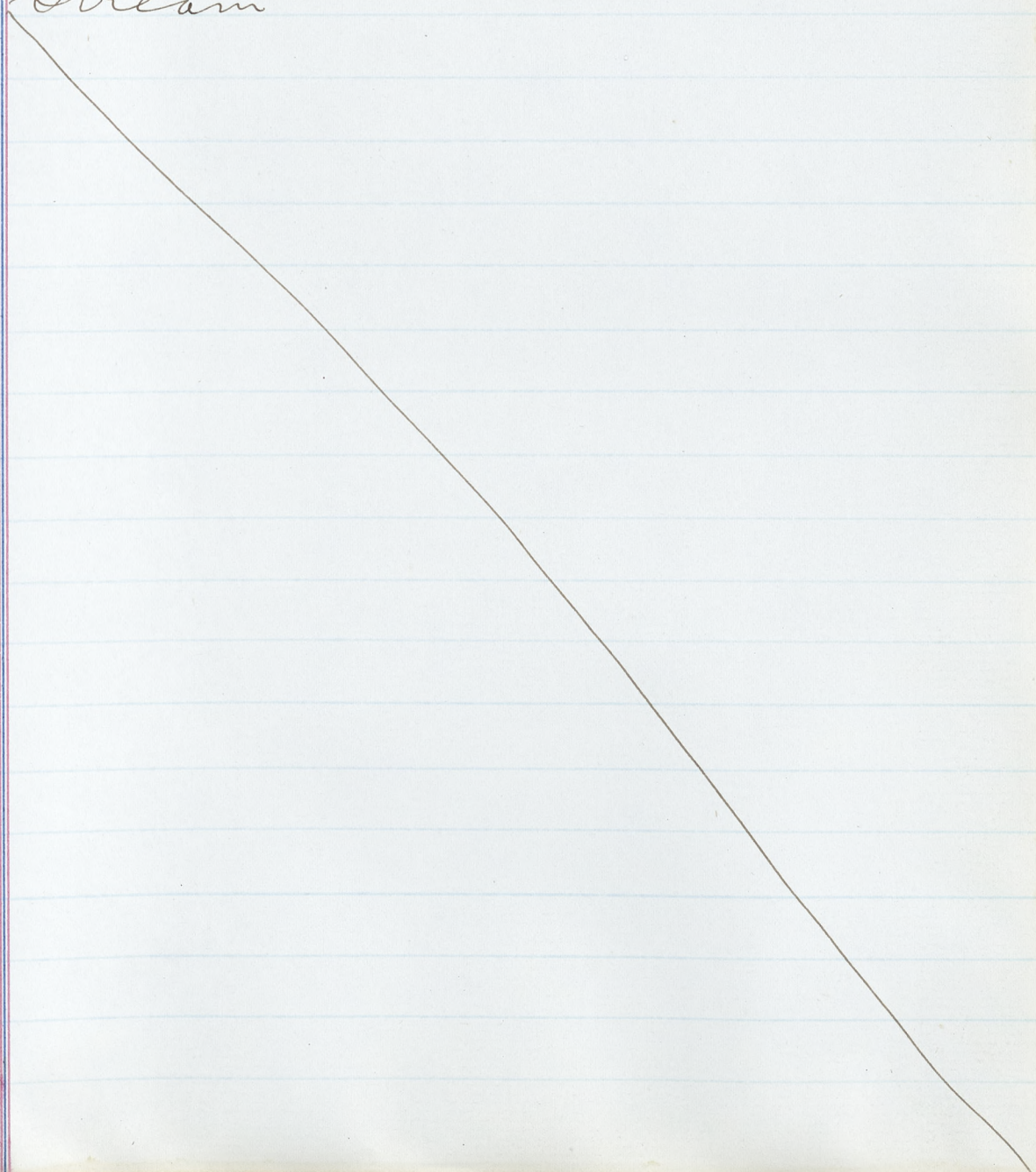
Q The bar that its own debris makes?

A No sir. The bar would act as a dam. It would act as a dam somewhat but it would not change the direction - it would not change the direction of the

Current. If two currents
are brought together at right
angles to each other that
makes a bar

Q It makes a bar?

A Yes. The River poured
into of course acts as a
bar to pile up the water of
the incoming or right angle
stream



Q When does the bar form in a river? A Well I think it forms at different times I could not say what time it may form at different times. If the current is very rapid I don't suppose there would be much of a bar formed. If the current was very rapid unless there was something to pull it back.

Q If you saw the bar here didn't you at the mouth of the American river when you were there?

A Yes sir I saw it.

Q. That occupied the whole bed of the river didn't it? A I presume it extended into the river, the water was so muddy I could not see.

Q The American river formed that bar didn't it?

A I presume it brought the sand there.

Q The bar is simply an

embankment?

A There are bars and embankments

Q And the embankments force the American river as it were, to discharge itself against the opposite bank of the Sacramento, didn't it?

A The bar had no effect of sending it down. It was the head of the river, the velocity that carried the water across there. The bar had a restraining influence of any thing

Q It could not get over the bar could it?

A I think it did get over the bar - the water was deeper than the bar.

Q Have you ever been to Marysville? A Yes

Q Have you ever noticed that same phenomenon where the Yuba enters the Feather? A No sir. I never was at that junction

Q Have you ever been at the mouth of the Feather River? Algeo. I have been to that some years ago when I went up the river.

Q Now wouldn't it be true in every instance that where a sediment bearing stream runs into one not so largely so that a bar is formed under the angle of their junction?

A Very likely, some portion of the sediment.

Q Is there any doubt about it. Is not that an inexorable law of nature?

A That would depend very much on the velocity of the stream and the angle at which they would come together.

If the angle is acute I do not think there would be any bar formed there.

Q If the American river were not a sediment

bearing stream it would not run in that direction would it?

At what direction?

Q. The direction it does now in entering the Sacramento? A well it would run between its banks and would continue in that direction until it was prevented by some cause. If a body is set in motion it is presumed to keep that motion until there is some cause to change it?

O I will put it to you in a syllogistic form, if the American river had no sediment in it it would form no bar would it?

A Is that the major premise of the syllogism? I think the major premise requires other things — we will take the second premise afterwards

and then we will come at the conclusion - state your major premise

Q. Was it explained to you in your trip after soundings why you were kept out - at the time you took the trip on that steamer after soundings was it explained to you why the soundings were taken in the North part of the Bay? A. No sir I had no explanation whatever in regard to it

Q. That is a State secret so far as you were concerned? A. I simply went on it to obtain those samples

Q. You did not expect to find any Sacramento grit over in that part of the Bay did you?

A. To find whatever was there if the grit had come down and settled there I expected to find it.

Q. You did not look at Petaluma Creek for any thing of that kind did you
 A. Well, it was very well to have samples of all these tailings to compare one with the other

Q Now you say you took soundings at the same time off Oakland wharf, that is the new depot? A. Yes sir

Q What did you find there? A. Those soundings contained some shell matter

Q No sand? A. It felt like grit but on closer examination, and on washing it we found that it was shell matter instead of sand?

Q You did not find any sand off Stockton Sheet then at North Beach? A. Yes sir we found sand there

Q But you say you

found none on the bar
at San Francisco?

A I did not go out to
the bar

Mrs Libble I did not ask
him anything about the
bar except whether the
river deposit affected
the bar of the Golden Gate
or whether it was by
the natural currents
coming up

The Court She did not say
anything about finding
any sand there

Mr Leachwalader I will
ask you whether the
bar at the Golden Gate
does not break there
now in the Summer?

A The bar break or
the water over it?

Q The water over it in
the Summer, a thing
perfectly unheard of
until a few years ago?

A It is pretty rough
out there and I think

the depth there is three fathoms, the least depth three and a half fathoms or three and three fourths fathoms, that would be 22 feet - no I do not think that the waves unless there was an extraordinary gale, I do not think that there would be what would be called a break over the bar.

Q I will ask you to state again whether that bar don't break in the summer, a thing that was perfectly unheard of 15 years ago?

A I do not believe that there is any difference now in what you term "breaking" from what there was in 1849. The bar as I understand by reading on the subject is just as deep, the water is just as deep over the

Bar now as it was then. There may be some change of the sands out there, they may change a little one way or a little the other but as to being on the whole a less depth over that bar now than there was 30 years ago I do not understand that such is the fact.

Q. Is not the water of the Bay of San Francisco at ebb tide now always colored? A. It contains more or less coloring matter.

Q. While at flood tide the water is as it used to be? A. No. I think there is probably a little more coloring matter in the Bay at present than there was formerly.

Q. The coloring matter from what?

A. Earthy material.

Q. Not black is it - not

black earth?

Ans. It is yellowish. It looks as you look on the water you see it yellowish brown

Q. It is distinctly marked particularly in the Oakland wharf? A well I do not know about particularly there but anywhere in the Bay you will find it more or less

Q. At ebb tide the water is always colored?

A. I do not know that. I have not thought or looked into that direction but I presume that at ebb tide there would be probably a little more coloring matter than there would when the water was coming in fresh from the ocean.

Mr Dibble I understand the witness is permitted to give his answers to those various questions in writing and make it a part of the Record

— " —

Mr Becher I offer from the State Board of Health Report for the years 1870 and 1871 the table showing the total mortality and then the mortality from certain diseases which have been called here zymotic; typho-malarial, scarlatina, diphtheria in several of the principal towns in the State including Sacramento. Also on page 58 the Table there, simply the totals; there it is carried out in detail, I want simply the totals in the same place. That is all that I desire to offer in that report of 1870 and 1871.

From the Report of 1872 and 1873 I desire to offer a table on pp 30 and 31 of typho malarial fever so called here, scarlatina and diphtheria

in the same towns. And then so much of the table as faces page 32. the totals, that is a detailed table, only the totals from that Table. On page 37 Table 4 so much of that table as relates to this class of diseases, the same class of diseases that I have mentioned. I take all diseases, what are here called zymotic diseases that are named in the Table. On page 42 of the same book, or facing page 42 rather is a table which applies only to Sacramento including the same class of diseases and those only. The same class of diseases in the table on page 44 in reference to San Francisco.

11875 The Next Report of 1874 and 1875 on page 22

number of the witnesses
in regard to the sewerage
systems of London and
Paris commencing in page
194

The Report of 1876 and
1877 the table facing
page 14 with reference to
the same class of diseases.

The Report of 1877 and 1879
the Table facing page 8
so far as this class of
diseases is concerned,
page 9, Table facing
page 10 with reference to
the same class of
diseases and the totals
Page 11 and page 20 and 21
are two tables in regard
to diphtheria. Page 66
to 69 on the sewerage of
Sacramento. It was from
that that something was
read yesterday.

The Report of 1880 con-
tains a Table facing
page 10 with reference
to the same class of

Table 1 with reference to the same class of diseases; on page 26 Table 3. giving the comparative rate of mortality for several years in different places, the first portion of that including several cities among which Sacramento is named. Table 4 facing page 28 the totals of the same towns to which reference has been made. The Table 5 on page 31 gives the figures of this class of disease, typho malarial fever, scarlatina and diphtheria the same way. Page 46 the Annual table of the Neurology of Sacramento with reference to the same class of diseases so far as they are given here.

Then the Report of Dr Lane of which mention has been made by a

diseases. Page 58 to page 73 the Sanitary Condition of Sacramento by Dr Statch. There is one table that I have omitted here somewhere which gives the necrology of Sacramento from 1850 up to I am not certain what year, I think to 1874, I am not now certain which year it is in but I will supply it, giving the number of deaths in this City from 1850 up to 1874 both inclusive. These tables also the most of them include the population and the population is a part of the offer.

Then one of those tables I desire to offer that is a Table given in the Report of Dr Montgomery a report given to the Trustees of this City made on the 26th of

June 1865 page 5 of that Report a table showing the comparative mortality from disease, chiefly from epidemics and endemics from April 1863 to April 1864, and from April 1864 to April 1865 with the same class of diseases in this City.

Mr Broadwalader the object is the evidence except so far as it purports to be the evidence of Dr Hatch. That we accept. As to the others if you will give me an opportunity of examining them I will do so.

Mr Becher You shall have an opportunity of examining them. Dr Hatch has been a member of the Board from its organization. He knows about those Reports.

Mr Broadwalader It is a

pretty formidable mass
of matter

The Court The better
arrangement would be
that anybody can read
from those Reports.

Mr Belcher I think it
would be better to agree
that we can read from
them. To that we shall
make no objection. Is
that satisfactory?

Mr Roadwalades Yes sir

Mr Belcher Then it is ^{so}
understood that these
are in evidence and
such other matter as
we desire to read from
^{either of} them. And this report
of Dr Montgomery was made
to the City Board here
and if it were requisite
I can prove it.

Mr Roadwalades We will
take it.

The Court Then Dr Mont
gomery's Report is in the same category

Testimony of F. B. Granger.

Called for deft

Suorn

Mr Belcher Where do you reside?

A Alvarado Alameda County

How long a time resident there?

A. About 28 years since I first came there -

I think

How far near Alvarado?

A Yes Sir

How far away?

A I live just half a mile from the center of town

And have you been intimately acquainted with that district for that number of years?

A Yes Sir

Some 28 years?

A Yes Sir

What was the condition of Alameda Creek when you first knew it 28 years ago?

A In what

respect, it was the same as all other Creek.

Q With respect to water - to navigation?

A. Steamers were running on it

Q Running up to what point?

A The Steamer Union City was running to Union City

Q Was that in 1853?

A That was in 1853

Q How large a boat was that, what class of boat rather? A Well, it was quite a large side wheel boat, I forget how many tons she carried but it was a larger one than has ever been run in there since or could run in there

Q Was there navigation still higher up the stream than that?

A They ran up with steamers to Alvarado, probably a mile or over by the creek above that, and then they went above there with

Schooners to get potatoes
and so forth to ship by
Schooners.

Q Light draft?

A Yes sir.

Q What is the condition
of that stream now in ref-
erence to navigation?

A Well, it has narrowed
down considerable, the stream
is smaller.

Q Well, can vessels like
the Union City go now where
they could in 1853?

A No sir.

Q Why not?

A Because it is filled up.

Q From what source filled
up, and to what extent?

A Well, the floods of the
Alameda Creek come down and
it is filled in back from
the sides and the bottom
and it is filled all it is
narrower up in places
so that where the boats
used to go, you could ^{not} get
up in a skiff.

2. Alameda Creek, where
does it get its water, where
is the head of it, what is
the extent of its 'water shed'?

A It is Alameda River. I
believe they call it, the County
of Alameda takes its name
from it. It heads up I
think in Calaveras and Santa
Clara Valley, I think in
Santa Clara County.

2 Running through a mining
or agricultural region

A Agricultural

2 When did it begin to fill?

A I do not know what
time, about 17 or 18 years
ago. I bought the place
but I know live on, and
I know it because I saw
that there was ~~now~~ sediment
on the ground, and I thought
it would improve the ground
and I bought the place. That
is the first I knew about
sediment to amount to any-
thing, to notice it partic-
ularly

2 Now what extent of Country has been here covered with sediment by that stream and to what depth if you know?

A. Well, it is pretty hard to tell. There are places that it has filled as high as the fences, the old fence posts, and others it has filled but little.

2 And to what extent covered in the neighborhood of Alvarado? A. That would be owing to how much land you took in.

2. Well, I want to take in what is covered with sediment from that Creek? A. Well, the creek when it is very high breaks out above and covers over a large portion above, that is adjoining Alvarado. There are seven thousand acres of land which are covered when the Creek is very high and some

Seasons it don't overflow,
 but it has all got sediment
 on it, some of it a good deal
 of it, and some a little

2. Well, to what depth,
 the greatest depth - what
 is the greatest depth that
 you know? a well, take
 any amount of acres
 it has covered may be
 four feet perhaps, a little
 over in places, there are
 places where it is a good
 deal deeper, but upon the
 bottom and upon the flat
 surface

2. Well to what extent would
 you say covered 4 feet deep
 or 2 feet deep, any depth
 what you may know of?
 a well there is probably
 a couple of thousand acres
 that would average 2 feet
 deep I should think

2. Now the Embarkadero ~~there~~
 or the landing place of the
 schooner, or of the steamer,
 or both; if it has changed

at all. Once you have known
 it what is the change, how
 much, what is the difference
 between the present landing
 and the old landing

A Well, the change is that
 they can not come up with
 in a couple of miles as far
 as they did. But they run
 a small steamer down to
 Union City - They run a
 small stem wheeled steamer
 to Union City a little below where
 we used to run in old times in
 1853 and 1854.

Well now how is the freight
 to and from Union City taken
 now by rail or by water

A Well, sometimes the boat
 comes up and brings some and
 then some of it is freighted on ac-
 count of the boats not coming
 up, is freighted by teams down
 to the foundries

2 Are there any manufactures

1 There are foundries down
 there and a soap factory

2 Is this creek a navigable

Stream under the law do you know? A I have understood it was.

Q Then the law will show whether it is or not?

A Yes sir.

Q You say there are some 3000 acres? A Yes sir.

Q Are there any manufactories at Alvarado that have ever been built there?

A The Beet Sugar Manufacturing Co have a manufactory there

Q Do you know of any reason why their works were put up at that point?

A They were formerly put up there on account for facilities for shipping sugar and coal up to the mill.

Q Well, do they still have those facilities, or are they in any way impaired?

A It is filled up below them now so that they run a rail road in there

Q What grant of land is there along that creek. What

is the name of the grant?

A. They call it the old Pacheco grant, the Alviso and Pacheco Ranch - on which side do you mean that is on one side the Vallejo Ranch is on the other

Q On the south side - you have spoken about the Pacheco we will ask about that - how much of the Pacheco Grant has been covered with the sediment of this stream?

A Well, there is probably half of it.

Q How many acres?

A Probably 4000 acres.

Q - 5000 acres and to what depth? A well, it has been covered from six inches to 2 or 3 feet.

Q Is that the ranch that is called the Portrero de los Cerritos? A I do not know, I think it is, I am not positive about it.

Q Confirmed to Thomas Pacheco and Augustine Alviso?

Ayer that is the ranch
 Q What is the length of
 this stream? A The entire
 length - I cannot tell you,
 I cannot give a guess at it
 I will approximate.

A I have been around the
 head of it, that is I have
 been where I should probably
 call the head - 70 miles I
 should judge

Q Is it a small or large
 stream? A Well, it is
 very large in the winter
 Q And in the summer?

A In the summer it is not
 much of a stream

Q Is there a place near
 Centerville called Crandalls
 Slough? Ayer sir.

Q Now in times of flood
 what do you say of the
 water there and the sediment
 at that point?

A That it breaks over and
 crosses near Centerville - it
 breaks over and crosses through
 the ranch there

2. That is through the Pacheco ranch or the ranch we have just spoken of?

A. Yes Sir when it crosses there, that is when it crosses, I should think at least half of the front of that tract.

Q You say it was about 18 years ago that you first noticed the filling, you had known the land prior to that time for a number of years?

A I bought it there then, I bought the property and then I noticed about the filling. Before that I never paid any attention to it.

Q Do you know what has been the cause of this filling, the erosion or wearing away and bringing down of so much sediment by this creek?

A Well it is the washing of the creek, washing out the gullies in the hills. The land becomes soft.

Q Did it do that before cultivation commenced?

A Not so much.

How is it with the hill Country toward the head water, and along that creek, are they under cultivation or not, or do you know?

A. Yes sir, most of the land, all the flat places, and the side hills are cultivated a good deal.

With respect to your own land does it come to your house - the sediment?

A. Yes sir.

What effect has it had here, what have you had to do if anything?

A. It fills in around my house and the year after I bought my place there had been a good deal of sediment settled on it and I raised it up out of the sediment, and in the course of 8 or 10 years I raised it again.

2. Has it had any effect in the upper portion of the creek or where the creek

What comes into the valley?
 In the creek itself, Either
 narrowing or widening its Chan-
 nel. A. It has widened
 it.

2 What is the character of the
 land that has washed away
 in widening this Channel?

A Well, it was close to the
 foot hills where the ground
 was spongy, where it sluiced
 into the ground and cut it
 out.

2. Was the land near the
 mouth of this creek low
 swampy land? A Yes sir.

2 What effect has this fill-
 ing had upon the swampy land?

A It has filled it in, and
 is filling it in all the time.

2 So as to render it Suita-
 ble for cultivation?

A A great deal of it is made
 suitable for cultivation.

2. How much land has been
 made and rendered fit for cul-
 tivation by sediment from this
 stream - approximately

Alwell, I could not tell you, there is a good deal of land there that they plow and try to make it good, when it is not good for anything and there is a good deal of it that has become good land.

Q. Well, I will ask you how much good land, if you know?

A. From the character of the land it is hard to tell, there is some of the land that was poor when they went there and was considered poor land that is now good land.

Q. Made so by the sediment depositing on it?

A. Yes Sir.

Q. And other land has not received enough?

A. Other land, as it fills up, and goes toward the bay they keep farming down and working down and keep improving the land and farming further on it all the time.

Q. This is a tide marsh,

is it?

Alfred

2. They get down too far into the salt water?

A They keep going down toward the bay. It keeps filling up. It makes the land toward the bay. The character of the land to understand it - it is heavy salt-weed just, and on top of that very coarse salt-weed runs down this deposit until it fills it up and raises it and then they farm it.

2 What is the value of that made land per acre the best of it? Well, land in there is worth from \$200 to \$300 per acre.

2 Are you acquainted with San Leandro and San Lorenzo Creeks? Alfred, I know something about them, but not so well acquainted with them as Alameda Creek.

2 Do you know about the filling of those creeks and the amount of material brought

down by them ?

A I know the San Leandro

I Do you know about the
Landing ? A I know
about the landing yes -
I know everything about it

2. Well state, if you know,
about that ?

All well, I know that they
have washed down a great
deal of dirt and covered
the fences in some places,
and one place there is a
warehouse standing there
now that the creek has com-
pletely gone, there is no
creek there, just a little
out of a hollow where they
used to ship from, - that
is San Leandro

2. The creek has turned off
in another course ?

A It has gone another way.
It has filled in and turned
off across in another direction
and has gone into an arm
of the Bay - San Leandro
Bay

Q. To what extent is the filling there if you know?

A. I do not know the extent, I have no means of knowing the depth.

Q. Do you know about the San Lorenzo?

A. I know the San Lorenzo - all I know is that the original course of the creek has filled up in the last 2 or 3 years.

Q. Are these short streams coming out of the hills a little beyond there?

A. Those are not very extensive streams they are not long streams probably 2 or 3 miles long I should judge.

Q. Do you know whether or not they come through a hilly country that is under cultivation or not?

A. They do, most of the country is so.

Q. Do you know whether or not they brought down

material in former years before cultivation commenced as they do now, or whether there has been any considerable change in that regard?

A I do not know. What I have seen of that, I have seen in the last 2 or 3 years so I am not familiar with it. I have been back in the country but I am not familiar with the banks of the creek, only as I have seen them in the last 2 or 3 years.

How far are the warehouses which you notice at San Leandro from the present landing or how far are they now from the water?

A I need not tell you exactly. They are away off. They are useless, they are half a mile off or such a matter. They are away off from the stream, they do not use them — they

never have since.

I have they filled in so
as to make solid land
from the the river to them
After this.

I am a half a mile or
more? After this

Crop - Examination of F. B. Granger

Mr. Cadavalader Alvarado is
one of these towns situated
on an estuary is it not?
After this.

I know from the bay.
A mile or six miles by the
creek, it may be a little
more - about that.

I and the majority there
has always been at high tide
has it not? After this,
they were coming on the tide
and they used to come fast
tides when the tide was
flowing.

2. Alvarado Creek Empire

into this Estuary don't it?
 A Alameda Creek - well
 I do not know, it is the
 mouth of the Creek, that
 is what it is. It is not
 an Estuary, it is the mouth
 of the Creek. The Creek runs
 right down there and it
 has widened out

2 Does Alameda Creek run
 past Niles? A Yes Sir,

2 The railroad runs along
 side of it there? A Yes Sir,
 2 How far is Niles from
 Alameda? A About
 5 miles.

2 Is it on the line of the
 South Pacific Coast Railroad.
 A It runs right through it,
 the narrow gauge runs through it

2 That is what is called the
 South Pacific Coast?

A Yes Sir

2 Do you do all your business
 by rail don't you?

A Most of the year, there
 is some work that is done
 by the steamer that runs there

get - They run a steamer once
a while

2. Is the town upon the
Central or the Southern Pacific
Railroad? After all,

I do you water communi-
cation has nearly become
useless - there has been no
attention paid to it of late
year has there?

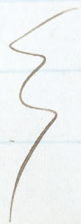
A Well, they could not nav-
igate the stream to make it
work - that was the trouble
with the creek

2. Well that was not what
I asked you. There has been
no attempt to improve the nav-
igation of it since the rail-
road crossed there?

A They use the rail road
now mostly for everything.

2 Well, the principal dam-
age to the Creek has occurred
since the railroad came there
is it not?

A No sir



Q When did it occur

A Well it has been gradually
~~quently~~ occurring ever
 since I have been there
 gradually filling up

Q When did it occur
 principally?

A Every wet Season,
 when there would be a
 big wet Season it would
 fill in more or less It
 has filled in the last
 two or three years - two
 years ago

Q What is the full
 of the tide in that
 estuary? A I could not
 tell you

Q This was I suppose
 caused from the hills
 principally was it not?

A Yes sir mostly

Q More than from the
 Creek? What proportion
 from the hill and what
 proportion from the Creek?
 A I could not tell you
 that.

Q Much larger I suppose from the hills than from the creek?

A Well there is more dirt comes from the hills and comes below

Q This fill is the wash from the hills is it not? It makes good soil?

A Yes sir it makes good soil

Q That section of the Country has not only been cultivated but has been extensively cultivated has it not?

A Yes. Q Since 1849? A Yes sir

Q Divided up very largely into gardens is it not?

A There is a good deal of gardening done there

Q And the soil there has been excessively pulverized? A Yes sir

Q As well as drained? that of course has contributed to the wash

has it not, much more
so than if there had
been cultivation of
the ordinary staples of
the State?

A. What part do you
mean has been cultivated
in gardens?

Q. I mean the Country
around Alvarado?

A. There is not much
gardening there. There
are a good many potatoes
and onions and such
things raised there in
large quantities.

Q. Speak a little louder.

A. They raised a good
many potatoes and
onions there.

Q. They raise berries,
don't they? A. No, sir,
not much. They never
raise much. They
raise sugar beets
now a good deal.

Q. The farming is more
like gardening is it not

than like farming?

Q. Well it is vegetable farming. On the sediment ground it is more vegetable.

Q. This sedimentary deposit I suppose has largely improved the land?

A. Yes sir, it has improved the land.

Q. Well the benefits are largely in excess of the damages? A. Yes sir, they try to get the sediment onto the low land - they try to change the creek so as to have it come there and deposit.

Q. I suppose it is part and portion of the natural operation that formed those flats?

A. I presume like enough that is further in the business than I have studied.

Mr. Cadwalader, I did not get your answer.

The Court. He says: like enough, but that is further than he has studied

Mr. Roadwalader. It has not been going on to an inordinate degree has it?

Ayes sir it has been. Since they have been cultivating and ploughing the land up in the hills it has washed out gutters and washed down and when there comes on a heavy rain it washed the dirt down and makes this deposit.

Q They plow the hill tops there, do they?

Ayes, they plough everything that they can plough now. They have got to ploughing all their hills now, side hills and everywhere where they can plough.

Q What rainfall do you have there? A We generally have 22 inches, that

is our average 22 or 23 inches. At times we have more and sometimes less.

Owll that creek runs pure water doesn't it?

A Sometimes it runs pure water

Q Clear water there at Niles's? A It is along in the summer when there is no freshet the water is clear

Owll as a general thing the year round? And sir when it is high it runs very muddy Owll it is only in high floods, a very small length of time in the year?

Awell some years we have had nine floods that I could ride in a boat from my house and in other years I would not have any, it is all owing to the year

Q It don't head in the
Snowy mountains does
it? Ayes sir, well the
highest peaks the snow
comes on frequently

It don't lie there perpetually
but there is a good deal
of snow there and after
a snow storm if there
comes a warm spell
it melts the snow and
it is sure to fetch a
flood

Q This is what is called
a Calaveras cow pasture?

Ayes sir

Q That is where the
stuff comes from is it?

Ayes sir it is there
and from there down

Q That was considered
good enough water for
San Francisco was it not?

A well I do not know
about that

Q How long is Alameda
Creek? A I could only
give a guess. I should

judge it was about 75 miles but I may be mistaken in regard to it, but I have been around it down through Pauley Pass. It heads up in Calaveras there and I should judge it was about that - somewhere in the neighborhood of that.

Q This fill of 2 feet how long has it taken to make it? A well, it has taken over 20 years

Q Very slight each year then? A some years it is deposited a foot or over and then again it would not deposit to amount to anything for another season

Q In passing over that soil anybody would see that it is very light, very porous wouldn't be, I mean the made soil this new deposit, it is very light and very

porous? Well some
 of it. I think the coarse
 sand if you would see
 it you would say the
 place was spoiled but
 in fact the coarse sand
 after a year or two gets
 to look like good soil
 and I am shipping some
 of it where I raised
 potatoes this year I
 am shipping it ~~potatoes~~
 to San Francisco for
 moulding sand. It is
 between a sand and
 dirt. It is not quite
 dirt it is a kind of
 sediment but I am
 taking it right from
 where I raised a big
 crop of potatoes and am
 shipping it to the City
 O Blue is it not?

A^{no} It is of a light color

O Have you any idea
 of the extent of country
 that that wash comes
 from? You say the

creek is 70 or 75 miles long - has it steep sides. A well in places it has steep sides and other places it is pretty near level slopes up from the side of the creek. It is a hilly country and it slopes off from the creek. There are many little tributaries that go into it some of them a mile long, some of them three or four miles long, it has several tributaries that come into it above

Q Do you know the extent of the watershed of that creek?

A I do not know. I have heard.

Q What did you hear it once? A I forget how much.

Q Was it 500 square miles? A I could not tell you. I have forgotten

how much but I know
that the survey was
made by Mr Oyer who
was a neighbor of mine
I have heard him talk
about it but I do not remember

Q Is it not 500 square
miles?

Mr Belcher He says he
doesn't know

A I don't know. I could
not tell anything about it
I have heard talk about
it but I am no surveyor
and I could not tell what
it is

Q What is the grade of
the stream from Miles
to Alvarado? A Well I
could not tell you that.
I heard somebody say
there was nine or ten
feet difference in those
localities

Q Or how many miles?
A In five miles

Q. That would be less

than two feet to the mile? A Yes sir

Q That stream carries sand does it? - which you describe as moulding sand? A Yes sir

Q Does it have any difficulty in carrying it? A No sir

Q There is not much water in that creek in the summer is there? A No sir

Q Is there any way that you could give us an idea of that watershed? That matter has been canvassed a good deal? The size of the Culaveras watershed?

A I could not tell you

Q You say it is 75 miles long, is it six miles across?

A I do not know

Q From rim to rim?

A No sir

Q You do not know, but it would be several hundred miles would it not?

A I think it would, that is my impression

Q. Where is that ranch you speak of - this Pacheco Ranch? Where is the Pacheco Ranch?

A. It lies on the south side of the Alameda Creek.

Q. Does it extend to the Bay?

A. Yes.

Q. Does it embrace this salt, marsh and tide land?

A. Yes.

Q. Is it composed mostly of the salt marsh and tide land?

A. No Sir.

Q. What part of it?

A. Well the lower part of it, next to the Bay.

Q. Well how much of the five thousand acres?

A. Well I could not say I do not know how much. I do not know how far into the Bay they would run it. I do not know what the boundaries are down there.

Q. Well about?

A. Two thousand acres or so - probably a couple of

thousand acres.

Q. That land is all covered in high tide is it not?
It is salt marsh and tide-land?
A. No Sir.

Q. How near does it come to be covered?

A. Well there are spots that are not covered.

Q. Do not the Spring tides cover it?

A. There are tides that pretty near cover the most of it; once in a while a tide comes that pretty nearly covers it.

Q. Do not the full moon tides cover it?

A. No Sir, not always. I have seen them pretty near cover it. But there are times when it is entirely covered as at high water where the Creek is very high and the tide comes in. Then it is all overflowed there, The country is all overflowed.

Q - This deposit has added very largely to the value of the Pacheco Ranch has it not? A. Yes it has made considerable good land there.

Redirect Examination of

T. B. Granger

Mr. Belcher

You were speaking in regard to the plowing in early times in 1849 was that on the hill-sides or in the valleys?

A. Sir?

Q - In 1849 and '50 and in the early days was the plowing in the valleys or on the hill-sides?

A. I was not there until 1853

Q - How was it when you first went there?

A. Well they were farming in the valleys then, began to farm.

Q- And not on the hills?

A- No Sir. not on the hills.
A few years afterwards
they farmed on the hills

Q- When you say these lands
were excessively cultivated
what did you mean?

A- Sir.

Q- What did you mean by
excessive cultivation?

Mr. Cadwalader wanted
that you should use that
expression that they were
excessively cultivated?

A- What I would call ex-
cessively cultivated, would
be in the cultivation of a
crop of potatoes that is
cultivating the soil and
putting them in, and dig-
ging around them afterwards.

Q- That is all you
meant by that term
thorough cultivation?

A- Yes.

Mr. Cadwalader That
is what I meant thorough
cultivation

Mr. Belcher If you meant
that you used a very ugly
term to express yourself.

Mr. Leadwacker They
plow the land some-
times four or five times.

Testimony

H. P. Jones

Called for defendant. Sworn.

Mr. Belcher Mr. Jones are
you acquainted in the
neighborhood of Alvarado and
about this Creek that has
been named by the last
witness, the Alameda Creek
A. I used to be well acquainted
there.

Q. Have you lived there?

A. Yes

Q. Since when did you know
it, the creek?

A. I have known it very

well since 1856?

Q - 1856?

A - Yes

Q - State what changes have occurred there in the immediate neighborhood of Alvarado and to your knowledge along that creek since 1856 both in the creek itself and on the land?

A - Well I should say that on both sides of the Creek, on both sides of the Creek there probably has been made of good land out of marsh land from a thousand to 1200 acres since I first knew it. That is merely a conjecture however, an approximation.

Q - You have seen it and that is what you judge it to be?

A - I have seen it and that is what I judge it to be approximately.

Q - Filled to what depth?

A - Well from fifteen inches to four feet.

Q - This filling commenced

principally when
 A- Well the first that I
 noticed of it was in 1862
 that is to any extent, the
 winter of 1861-2. I lived at
 the Rancho De Los Herritos
 I owned a large portion of
 the front of that ranch at
 that time

2- Now in regard to the
 navigation of that Creek
 and the changes upon the
 Creek itself?

A- Well the Creek has filled
 in and it has very much
 narrowed

2. It is filled up there and
 it has very much narrowed?

A- Very much narrowed
 and that portion of it that has
 been navigated heretofore
 has got so that it is very
 much affected by the tide.

In other portions of the creek
 higher up I think the channel
 has widened and there has
 been a great deal of land
 taken from the North side

of the creek and throw in on
to the south side and vice
versa in places.

Q- How far up can vessels now
go. How much less distance
can they now go than when
you first knew the creek.

What changes have been made
with respect to navigation.

A- I should think there is
about two miles difference.

Q- About two miles difference
now from what you knew it
in 1856?

A- Yes about that.

Examination

W. P. Jones

Mr. Badwalader You
heard the testimony of Mr.
Granger did you?

A- Yes.

Q- Is that just about right,
as far as your knowledge
goes. Was his testimony

just about right as far as
your knowledge goes?

A - Well I did not follow
him especially to know what
he did say.

Q - Your wife are Alameda
Creek?

A - No Sir. I
live in the City of San
Francisco at present.

Q - How long have you
lived there?

A - Well I have not lived in
Alameda County since
about 1864, but I have
been there frequently and I
owned land up there for a
number of years after I
left there. I sold it some
years since. I went up
with Mr. Lewis and saw
the changes that had been made.
I did not see those changes
as they went along but I
saw the changes that had
been made from former
times.

Q - You have not lived
there since 1864?

A - No Sir, not regularly.

Q - That is the Calaveras
Cow pasture watershed?

A - I think the head waters
is - but I am not familiar
with the headwaters of this
Creek above, in the hills, I
have not been through there

Q - It is in what has been
called the Calaveras Cow
pasture watershed?

A - I think it is - that is
what I have understood

Q - What are the dimensions
of that watershed in square
miles?

A - That is something I
can not inform you about.

Q - It is nearly as great
as that of the American
River is it not?

A - Well that is something
that I have not ever paid
any attention to and therefore
I could not give you any
approximate idea of it. I

think there is quite an ex-
tensive water shed there but

have extensive. I could not say.

Q. And this debris comes down the Creek from the adjacent hills?

A. It comes down in the extreme high water and floods.

Q. I suppose you will say that this process that has been going on there, this filling is a part and parcel of that which made the salt marsh and tide-lands?

A. Well I should think it likely. The changes that I have seen are the making of good land out of salt land, that is the principal change that I have seen.

Q. This salt land comes from the washing of the hills around into salt water I suppose?

A. Yes I suppose so. When it gets filled up high enough with fresh land it becomes

cultivable.

Q. That salt marsh land has been made by the washing of the hills of that character there has it not?

A. What is that?

Q. The salt marsh and tide land there have been made by the same causes that made this fill of which you have been speaking?

A. It is very possible - it is very possible.

Q. The filling is very light considering the quantity of water in the River, the Creek and the extent of the watershed?

Mr. Belcher Do you state that as a fact?

Mr. Badwalader I ask him that question.

A. Would I consider it very light?

Q. Yes considering the extent of the stream the character of the soil and the extent of the watershed?

A. Well I do not know as I could judge. I was rather surprised to see such amount of land filled in.

Q. Suppose the watershed had 500 square miles of territory?

A. Well if all that land was cultivated I should think probably it would fill in more rapidly than it has.

Q. The land is not timbered is it. The hills are not timbered there all along the creek?

A. After you get into the hills there is considerable timber.

Q. I mean on the hill-tops?

A. Well on some of the hill-tops there is timber.

Q. Heavy timber or light timber?

A. Not very heavy timber no sir.

Q. There has been a good deal of cord wood cut up

in that canon - in what is called the canon of the Flamedda. All that ^{land} in that neighborhood is very high is it not and always has been?

A. What do you mean, in regard to elevation or to price?

Q. Has not the land in the neighborhood of Flamedda Creek always been high?

The land He means in price.

Mr. Leadwelder Yes, high in price?

A. Well no, it has not always been so but it has been so for a number of years.

Q. It has all got to be worth over a hundred dollars an acre? A. Yes a good deal over.

Q. And up into the thousands?

A. As far up as the foot of the hills.

Q. They sell those hills for \$50 an acre do they not?

A. I would presume that some of those

hill lands would sell as high as that.

Testimony
of
William J. Lewis

Called for the defendant. Sworn.

Mr. Wallace - When did you come to California?

A - I came in June 1849.

Q - Where from?

A - I came directly from New York.

Q - What has been your business or profession?

A - I am a civil engineer.

Q - Where did you commence that business?

A - I commenced it in Pennsylvania.

Q - When?

A - In 1828

Q - How long did you pursue it there?

A - I followed that business

all the time from 1828 to 1849
in the East.

Q. What positions did you hold there if any? A. In 1828 when I was not quite 16 years of age I commenced as a chain-man and I held different capacities. I was Resident Engineer and Chief Engineer of several railroads and I resigned my position as Chief engineer of the New Jersey Railroad in January 1849 to come to California.

Q. In California what positions did you hold in that same line? What have you done in California in the way of civil engineering? A. I went up to the Mines and then returned and came down to San Jose in December 1849. I went up in June 1849.

Q. What did you embark in then? What was your business from that time on?

A. My business has been that of civil engineering.

Q. What positions have you held in Santa Clara in connection with that? A. In February 1850 I surveyed the Go Gatos Rancho under an order of Court of First Instance.

Q Were you ever County Surveyor of Santa Clara County?
 A Yes. but that was before that. In July 1850 I was appointed County Surveyor in Santa Clara County. I held it under that appointment. I was elected in 1852 and Re-elected in 1854 and I held the position until June 1855 when I resigned and went to San Francisco to take charge of the surveys of the City.

Q What else did you do during that time in the way of surveying, Did you survey the Rail Road Route from San Jose to San Francisco?

A Yes

Q When?

A In September 1851 I was appointed Chief Engineer of the San Francisco and San Jose Rail Road Company.

Q How long did you hold that place?

A I held it under different

Organizations up to 1864.
It changed its name once
or twice. I made three sur-
veys one in 1851 another in
1855 and finally another one
in 1861-62. I superintended
the Construction of the Rail Road
which was finished in 1863

© What personal familiarity
with the situation of the Country
around the bay of San Francisco
and the County of Santa Clara
and Alameda etc have you
enjoyed during that time -
during your residence in
California what means of
information have you had
As well as that time the
limits of Santa Clara County
were to the Alameda Creek
on the North. I made a great
many surveys within the
limits of Santa Clara County
as then bounded up to
Alameda Creek, including
this Rancho Los Beretos
and including also Livermore
Grant and a great many

Many others in Santa Clara County.

Q Mr Lewis during all that time you had occasion to observe the effects upon the lands down there generally and the amount of wash and fill as you understood it of the ravines creeks etc and the effect of the denuding the soil of timber as to filling and washing?

A Yes.

Q You had occasion to observe it? A Yes

Q State what you know about it in a general way - what have you observed

A I made a survey of the Los Gatos that was the first I made. That is right opposite the town of San Jose. I surveyed it in February 1850. That was the first survey made under the direction of the Court of First Instance. I made a survey of the boundaries of that

Rancho, one of which boundaries was Los Gatos Creek. Then in the summer of 1851 - the summer of 1851 was a very dry season - I laid out a ditch which was only about two feet wide for the purpose of carrying water for the purpose of irrigation from the Los Gatos Creek, cutting off a bend of the Los Gatos Creek and running into the Guadalupe. There was a little dam put in there to turn a portion of the water, when the rains occurred into this little ditch. There was no water then there as you must understand it was a dry season.

Q In the Los Gatos?

A There was no water in it at that part of the dry season. And when the rains came there was a gate there that ought to have been opened when the rains came it filled it up. It occurred on a stormy night, and the man

who was entrusted with it neglected to open the gate. The ditch belonged to a Com-juny. The consequence was that this narrow ditch widened our area became as wide as the original Los Gatos Creek
 Q About how wide?

A About 50 feet on an average clear through

Q The ditch you say was two feet wide?

A About two feet and it widened out about 50 feet and it changed completely the Channel of the Creek and so completely that afterwards when I made a survey in 1856 for a United States patent of course following the lines I had located there a man in San Jose one of the most highly respected citizens of San Jose, since deceased was willing to swear - this old Channel was filled up - he was willing to swear that that new Channel where the

Creek had run all the time, it was so completely changed. That was the first experience I had of the effect of water in California to wash away the soil. Now in regard to the Survey of the San Francisco and San Jose Rail Road, of course we have the Courses and distances and a profile of the whole route and I can show that the streams, all the principal streams run on the top of the high land, on the top of the ridges—on the crest and that is a characteristic of the country I presume you will have to allow me to look at the profile. Can you refer to anything that will assist you—

Mr Caswell What do you refer to

A I am now going along the route of the San Francisco and San Jose Rail Road

Q What do you have reference to?

A I offer in evidence to illustrate this map of the San Francisco and San Jose Rail Road as located by the proprietors. Wm J Lewis Chief Engineer, drawn by G. F. Allardt

Mr Cowell You did not make that map

A It was made by Mr Allardt he was my assistant he was my draftsman. It was made under my direction. It is certified not only by him but by the president of the Company and by the Chief Engineer of the Company and by the Secretary of the Company

Mr Wallace Q What do you say now appears from that map about the matters we have been talking about, as to the changes that have taken place and state the circumstances

A The Rail Road runs from San Jose to San Francisco and it is at those different points which only can be shown by reference to the map. I

Presume his honor had better take that map so as to understand the references

Mr Wallace The witness has a statement which he has prepared at my request under the impression that these experts would be allowed to hand in statements of their testimony.

Mr Cadwalader Suppose you hand it to me and I will look it over between now and tomorrow. I might not want to ask him any questions.

The Witness I can read it now. How much time have we got. I will read it now and if there is anything you want you can cross question me

Mr Cadwalader If you will hand it to me there may be no necessity of reading it

The Court You mean that you will consider it in evidence.

The witness I prefer reading
it.

Mr Wallace Is that statement
exactly in the situation you
want to have it

A No. It is here in scraps
and I cannot give it to
you in a satisfactory way
Or else I would do it. It
will take but a few minutes
The Court go on

Mr Wallace State what you
have had occasion to observe
At or 10.41 miles from San-
Jose the Rail Road crosses
Cupertino Creek. Three quarters
of a mile below the old town
of Mountain View on the
San Jose and San Francisco
County Road. Above Mountain
View the banks are high
and while there is no water
in the dry season it flows
out in torrents during the
rainy season in one channel.
Below this point the Creek in
high water divided into
several small and shallow

Streams and spread over a plain and deposited sand and gravel. In 1851 - that was the time I made my first survey you recollect - there was little deposit below the town. I ought to explain that in the first survey in 1851 I run just above Mountain View, Close by Mountain View. I want to make this explanation because the present location is below. There was little deposit below the town, and in 1856 it did not extend more than two yards below. After the fresher in the winter of 1861 - 62 it extended down to the Rail Road, or more than half a mile below its former limits and for a width of half a mile on the Rail Road from the Aloiso Road to the bridge 40 feet in span which we built to carry off the water. There was also a slight deposit of sand on Martin

Murphy's land east of the
 Alviso Road and on John
 land North of the
 bridge. The gravel brought
 down was in many places
 from four to six feet in depth
 and large quantities were
 taken to ballast the Rail Road
 from San Jose to San Francisco—
 quite, a distance of 17 miles.
 Shall I state what my object
 was in showing that the
 Creek ran on the highest
 parts? At the crossing of
 Cupertino Creek the natural
 surface is 98 feet above
 high tide and it is greater
 than any other point in the
 Valley crossed by the Rail
 Road. The Creek runs on the
 highest ground. Then coming
 towards San Francisco the
 land descends for 17000 feet,
 three and one sixth miles,
 to Los Gatos, where the
 top of the bank is 41 feet
 above high tide or 57
 feet below the surface as

Cupertino Creek. The ground continues to descend for 7200 feet, nearly one and one half miles further, where I think the natural surface is 25 feet above high tide and 16 feet below the banks of Yezus Creek or 16 feet below the crest of Cupertino Creek. Then the land is nearly level for a thousand feet and then it ascends for two and one eighth miles to the bank of San Francisco Creek, the height of which is 79 feet above high tide or 54 feet higher than the ground two and one eighth miles south of it. It raises 54 feet and then comes to the bridge. The depth of the bottom of the channel or the creek bottom or the creek below the banks is about ten feet. The length of the bridge across the creek is 600 feet. Beyond the San Francisco Creek the

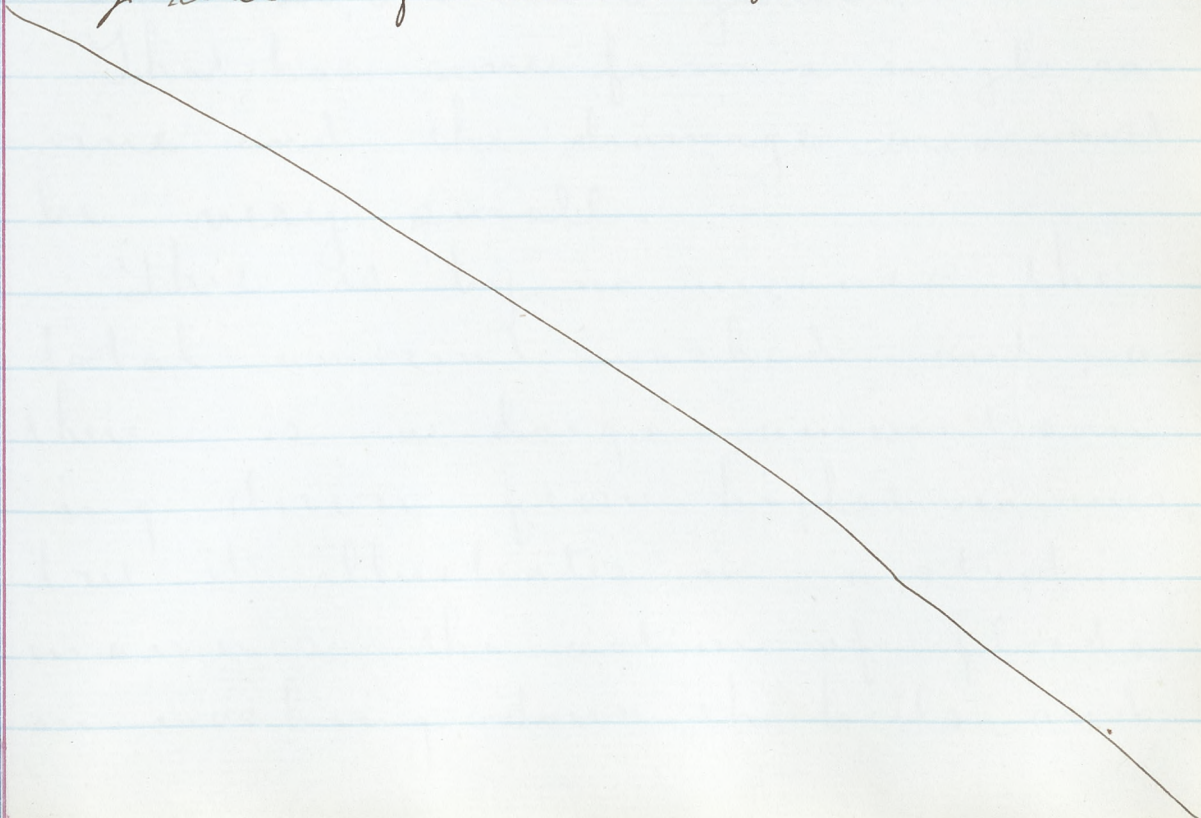
ground falls a little and as
 1200 feet it is 22 feet below
 the banks of the creek and
 of course 12 feet below the
 Channel of the Creek, after
 which there is a gradual
 descent to Redwood City
 which is but a little above
 at extreme high tide. The
 long ridge which forms the
 Cradle over which the water
 of San Francisco Creek
 runs extending from the base
 of the Mountains to the bay,
 many miles in length, was
 nearly the same in height
 and length in 1849 and was
 doubtless the result of over-
 flow of many centuries prior
 to that date. I will now
 explain the cause which
 has produced these results.
 Any one observing a stream
 bursting out from the side
 of a mountain in the rainy
 season will see that it deposits
 sand and gravel ahead, the
 surface of which is higher than

the adjacent land. The next year the stream makes a Channel through and over the debris previously deposited in the Channel and it deposits more sand and gravel ahead the same operation occurring year after year, in the course of time these deposits will extend many miles into the plains, forming the Cradle or ridge through which they run. In the Sacramento Valley between Oroville and Tehama the Stage Road crosses several high Arroyos, the banks of which are generally covered with timber and they stand prominently out in the plain. In fact if the traveller sees a hill ahead he may be absolutely certain that as the Crest he will find the Channel of a creek dry in summer but flowing full in the winter season. The Valleys were originally there of marsh or old clay soil.

and these deposits have given greatly increased value to the land for agricultural purposes. Returning to the line of the San Francisco and San Jose Rail Road, now the Southern Pacific I will call your attention to the crossing at the San Bruno turnpike at San Bruno Station 35.7 miles from San Jose and 14.3 miles from San Francisco. The adjacent land to this place to a point 2268 feet south has been filled up by debris on both sides since 1862 when the Rail Road was completed over about 50 acres or 25 acres on each side of the Rail Road. At San Bruno Station the fill is only three feet and westerly along the San Bruno turnpike the fill extends to the County road. The grade of the Rail Road has been raised from San Bruno

South and some additional
 water ways constructed but
 the Rail Road embankment
 has intercepted portions of the
 debris on each side and it
 extends to the marshy land.
 An approximate estimate
 of the deposit is 25 acres
 on the west side average
 depth the deposit is one and one
 half feet equaling 60 250
 Cubic yards. And 25 acres
 on the east side average
 depth one foot equaling
 40 333 Cubic yards. Total
 100 583 Cubic yards. The
 San Francisco and San Jose
 County Road runs nearly
 along the base of the hills
 which lie to the west and
 from those hills the debris
 in the valley is derived. A
 large portion to the south
 from the station has been
 washed down on the southern
 portion of R. G. Sneaths place,
 known as the Jersey farm.
 It has changed proprietors

though, Originating near the summit of the hills a deep channel has been formed within the banks that has run through D. A. Mills and Mastick's properties to the County Road which it crosses at a point at right angles to the Rail Road at San Bruno Station. This shows where it commences. The ravines south of the road and the general wash from the hills supply the rest of the deposit. North of Mr. Sneath's residence there are deep washes of recent formation the debris from which takes down a ravine which is crossed by the Rail Road at the Riley Culvert and a short distance below connects with the tide and a marsh of the bay west of the San Bruno Road.



I measured a few of these washes the dimensions of which I will give. No. One: width at bottom, 60 feet; average depth, 22 feet on lower side — no, depth 22 feet on lower side, 40 feet on upper side; slopes $\frac{1}{2}$ to 1; length 270 yards; contents 41,650 cubic yards.

Number Two: width at bottom 40 feet; average depth 15 feet; slope $\frac{1}{2}$ to 1; length 200 yards; contents 15,833 cubic yards.

Number Three: width at bottom 14 feet; average depth 40 feet on lower side, 60 feet on upper side; slopes $\frac{1}{2}$ to 1; length 500 yards; contents 63,333 cubic yards. Total 120,816 cubic yards.

That has come from a single ravine and the drainage area must be very small.

This is by no means the total amount washed out, as there is a large amount coming down from higher ravines, but it illustrates in a striking manner the action of floods in washing down the hills and

filling the valleys.

Before the land was cultivated these washes had no existence. The soil being broken the water finds a passage and sweeps away the light material below, exposing the adjacent land to its action. A channel being established the wash extends down the stream and upwards in the hills and there seems to be no limit to its action short of the summit of the hills; it works back. Sneath has erected two dams below the washes described to impound the debris. Building at first that low dam he makes use of the debris, when it is partially filled up, to increase the width and height of the dam. I am of the opinion that a similar device might be employed to impound debris of the American River.

The next place which I will note is a creek emptying in the marsh near Charles Suxhouse,

the valley of which is followed by the railroad, which I shall designate as Sux Slough. This valley is bounded by Mount San Bruno on the north and Santa Cruz mountains on the south. A ridge designated as the San Miguel Hills, 150 feet above tide at the lowest point, runs transversely across the valley and constitutes a divide between the waters running into the Pacific Ocean and those running into the Bay of San Francisco. The Colma station on the Southern Pacific Railroad 9.2 miles from San Francisco and 40 - 8 from San Jose, is on the summit of this dividing ridge. Where the road of the San Pedro rancho crosses the Southern Pacific Railroad in the sea and bays of this ridge a creek, issuing from the bays of the San Bruno Mountains crosses the railroad and unites with a branch running from the Santa Cruz

Mountains in nearly an opposite direction and bending at about a right angle, assumes a south-eastern direction and runs through a narrow valley in which the Southern Pacific Railroad was located, to its mouth at the head of Lux Slough near Charles Lux house, a distance of two and a half miles. At the junction of the stream and the head of the valley the average width of debris was about 200 feet, and depth about $1\frac{1}{2}$ feet. Several small streams enter above McMahon's station. At McMahon's station one mile below the head of the valley and $\frac{1}{2}$ mile above the mouth of the creek at Baden station, a large influx of debris comes in from McMahon's Creek entering on the right or southwest side and to this my attention was particularly directed. A road runs across the valley to McMahon Creek; the width of overflowed land across valley on road,

400 feet; fence posts several feet long, now projecting two feet above the surface, allowing one foot for depth of posts sunk in the ground, 40 feet filling at this point. I know that this was built subsequent to 1854 and probably not earlier than 1872. I followed McMahon Creek and found the filling in of debris about an average depth of three feet, extending to his stable about half a mile from the valley, above which the ground is badly washed.

On McMahon Creek at the junction of Casey's Creek the washes are of the same character with others found on Sneath's land.

Above the stable deep washes begin. It is 550 feet above stable width at bottom 30 feet, at top 66 feet, depth 12 feet. At junction of a branch coming in on the left and the south width at bottom 28 feet, depth 27 feet. About 700 yards above stable creek and ravine come in on

the left on land between Casey and McMahon's; a channel 50 feet wide on top and 50 feet deep. At the junction of McMahon Creek and Casey Creek the depth is 30 feet, width at bottom 20 feet, slope $1\frac{1}{2}$ to 1, making width on top 137 feet. At 200 feet above junction of Casey's Creek and stopping, being unable to proceed further on account of washes in Main Creek and side washes extending further in the hills; could see that the washes extended 200 yards above this point, the view being concealed by the intervening hills. I passed through this land during one of the great storms in the winter of 1862. I came from C. Lux's place to Baden station, to San Pedro road and along it to the County road near Colma, and along the latter to San Francisco, Lux's valley being overflowed with water. There was then no wash out but it would be in-

possible to traverse it at the present time on account of these washes. Returning from Baden station I measured the width of land overflowed at Lux valley.

At a narrow point opposite the hill, about 100 yards below the station, I found it to be 200 feet. Below this the valley widens and at its mouth or entrance into Lux Slough the overflow has a depth of 300 feet and has been filled in since 1862 to a depth of 9 feet.

I estimate the deposit of debris in Lux slough above McMahon's: Length 1760 yards; width 100 yards; depth 2.75 feet; equal to 161337 cubic yards. Below ditto: Length 2640 yards; width 100 yards; depth 6.5 feet; equal to 572,000 cubic yards. Total 733,337 cubic yards. All this has been deposited after the freshet of 1862; most of it within the past four years. The accumulation of debris at Lux slough and across Malaly's land and Malaly

creek overflow the railroad which raised several times. And this constantly occurring, about three years ago the Southern Pacific Railroad Company changed the location of their road from station 890+50 to station 838, or for a distance of 5,250 feet, or nearly one mile. At the mouth of the creek, station 870, the present line is 170 feet to the right of the former location and the grade has been raised 16 feet. The railroad crosses Six Slough nearly at its head and the debris deposit on old line of railroad since 1869 averages 7 feet in depth for a distance of 1700 feet. At the point where the slough is crossed by the San Bruno turnpike the filling in has been about three feet. At the Riley culvert, station 820, the filling has been four feet. From the best estimate I can make I calculate that the area of land filled in is about

250 acres to an average depth of $4\frac{1}{2}$ feet, or $1\frac{1}{2}$ yards; making the amount of debris deposit in Sux slough, between the railroad and the San Bruno turnpike, 250 multiplied by 480, multiplied by $1\frac{1}{2}$, being 1,815,000 cubic yards.

In 1851 when I made the first survey of the San Francisco and San Jose railroad the tide came up to Sux's land and the adjacent land was salt marsh which is uniformly at the elevation of the spring tide or about two feet above ordinary high tide. The top of the debris is now 22 feet above ordinary tide, showing a filling in of 20 feet since 1851. The next place ^{which} I have is Alameda creek. Where is that little map?

Mr. Wallace. Do you mean of Berritos?

A. No, the little County map, the small one, the map of Alameda County.

Mr. Wallace. Is this map you refer to? ~~ref~~ (showing)

a. Yes. This creek is formed
 by the junction of Sanol creek,
 coming from the Livermore
 valley, and of Calaveras creek,
 coming from the Contra Costa
 range of mountains. The creek
 pierces through the Contra Costa
 range in a cañon bounded
 by steep, rocky hills on each
 side and reaches the plains
 above Niles station and Valejo
 mills. There the cañon has an
 average width of 300 feet
 and as soon as it strikes the
 plains it is swept away a
 large amount of earth; and
 the channel at Niles, and
 for three miles below has been
 widened, shallowed and changed
 so that only those residing in
 the neighborhood can tell
 where the original channel
 was. In 1850 I made sub-
 division of the rancho Patero
 der los Cerritos which extends
 along Alameda Creek from
 the town of Centerville to the
 Bay of San Francisco.

Q. That is the Alviso and Pacheco ranch?

A. That is the Alviso and Pacheco ranch. In October and November, 1860 I made, as United States Deputy Surveyor, a final survey of said ranch. I submit a copy of the map of this survey, made at the Surveyor General's office and ~~surveyed~~ ^{certified} by Theodore Wagner, Surveyor General.

Q. This is the one? (showing.)

A. That is the one. In 1877 I made a re-survey of the tract belonging to H. Overhacker adjoining the ranch surveyed on the east and having the bank of Alameda creek for one of its boundaries. This land was part of the lands of the Mission of San Jose and was surveyed by the United States Government in 1870. I found the course of Alameda creek had so completely changed that it ran in front of Overhacker's property a very large distance of quarter of a mile to the northward, giving him some

60 acres of additional land. This land was a little above the level of the creek in 1857 and in November of last year I visited it again and found the washed out portion had been filled in to nearly the level of Overhacker's other land. Several important changes have taken place in the course of Alameda creek west of Overhacker's place on Paterno de los Ceritos rancho. At Mrs. Sanders' ranch adjacent to Overhacker on the western line, between October 1852 and Nov. 1860 the bank with Alameda creek had moved northward 7 chains, and between 1860 and September 1863, 10 chains further moved 17 chains. Between November 1860 and December 1863 the channel of the creek changed, running straight from ~~section~~ ^{station} 69 to station 26 — on the map — and cutting off a bend. The extreme distance away is 20 chains; that is, quarter of a mile. The great deposit of

debris from Alameda Creek has been in the vicinity of ^{Alvarado} ~~El Estero~~. When the creek formerly overflowed the overflows, water and debris or sand passed through a slough running south-westerly from station 40 to crossing the County road at what was known as the Hogg ranch one mile above the town of Alvarado. I made a survey in 1850. All the land west of this was swamp land. The debris subsequently was chiefly deposited on the west, or marshy land. About six years ago a break up of the bank of the ~~river~~ ^{creek} on the north side occurred and in high-water the overflow goes into Morse creek. From personal examination and the best information I can obtain I estimate that the overflow of debris amounts to 300 acres on the south side and 400 acres on the north side and with an average depth of three feet, making the deposit of debris

equal to 780 acres to a depth of one yard and giving the contents for debris deposit, 780 multiplied by 4840 which would be 3,775,200 cubic yards. I will state here that I was not aware of that deposit that occurred above there, so I have taken no notice of that through — what is the name of that new slough that was opened, that new pass?

I, I do not know. Go ahead.

A. Well, that is what goes coming from Alameda creek near Alvarado. When the Government survey was made in 1860 the head of navigation was at station 26. Since the flood of 1879, no steamer has come up to Union City landing, but the practical head of navigation is at Benson's warehouse at station 9, 152 chains, equal to 1.9 miles below the head of navigation in 1860.

as that map shows I have taken in some swamp land, I will

read some extracts from the report showing the reason of it, showing why I was obliged to do it.

2. What do those extracts show?

a. They show the reason. You see ordinarily when you strike the high tide, the line of high tide, there is a boundary of the rancho. But this ranch was the rancho der los Cerritos and it would not do to survey the rancho and leave the Cerritos out. It would be like the play of Hamlet with the part of Hamlet left out by particular request. Therefore these observations were made, because I was obliged to bring in the Cerritos in the survey, and it would show that I had included land that was undoubtedly overflowed by the tide, in the survey of the ground. Mr. Catwelder. I do not regard that as material.

Mr. Wallace. What does that show?

a. It shows my reason why

I took in land that was over-flowed. If you do not regard it material, if you are satisfied with it verbally it is enough.

Q, Yes, that is enough. Now, are you through with Alameda creek?

A, Yes, I believe so.

Q, Now have you had any occasion to notice in the San Jose Valley? Do you know the Coyote and the Guadalupe creeks?

A, Yes.

Q, They run parallel, I believe?

A, Yes.

Q, About how far apart?

A, Well, about two miles.

Q, San Jose is between the two?

A, San Jose is between the two. One is on one side of San Jose and one on the other. At San Jose it is not as far as two miles apart. I believe, but then gets wider.

Q, Do those creeks give any illustration as to the effect of denuding the banks of timber,

of growth, natural growth?

A. Oh, yes.

2. How is Coyote creek in that respect as to its banks? Are its banks covered with timber?

A. No. ^{Guadalupe} The ~~river~~ from San Jose down to pretty near Alviso, there is timber on both sides of it.

2. Of the Guadalupe?

A. I am now talking of the Guadalupe which runs on the west side or south west side of the city of San Jose. The banks are rather higher than the adjacent country. The stream is very crooked. Then there are a great many little coves in it and those were the proper places for building houses, you know, in the timber. For that reason the parties along there - it was subdivided among many persons - were very careful to preserve the timber and not cut any of it down but rather to augment it.

2. How is it with regard to Coyote creek?

A. Where the consequence of having

the timber there is that there is no washing away ~~so~~ far as I have known, no washing way at all of the banks of the Guadalupe until you come down very near to Alviso where the timber ~~of~~ cuts out and then there is an overflow, a slight overflow, which runs into the tract of land bought and reclaimed by John Center, which rather improves the value.

Q. Now, the Coyote is barren of timber?

A. The Coyote is barren of timber.

Q. Pretty much its whole course?

A. There is very little timber along it from where it enters the San Jose Valley for 20 miles.

Q. Now, what is the effect upon the banks of that stream? or what sort of a stream is Coyote? What does it do?

A. The Coyote is very nearly dry in the summer, in the dry season, but carries a large amount of water in the rainy season.

The banks are being constantly torn down. I suppose you know-

perhaps show that place that
Day and myself had just
crossed the Cayote was. ~~~~~
There was a large quantity of
that that was completely torn
away. The banks there I suppose
were at least twelve or fifteen
feet high.

The Court here took a re-
cess until Wednesday at 9.30
o'clock A.M.

In the Superior Court
of the State of California
in and for the County of
Sacramento

The People of the State of California	} Morning Session Wednesday July 18 th /82
vs. The Gold Run Ditch and Mining Company	

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Winfield J. Davis
Official Reporter

12047

In the Superior Court
of the State of California
in and for the County of
Sacramento.

The People of the State of California vs The Gold Run Ditch and Mining Company	} Morning Session Wednesday July 18/882.
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Testimony

of
William D. Lewis

Direct examination resumed.

By Mr Wallace. You have been speak-
-ing of Alameda Creek, of its
filling up etc. Will you state
what the grade of that creek
is from Niles to its mouth?
A. Yes. I will state it - from
my notes. My notes on the
Western Pacific Railroad, where
I was engineer; and I take
the crossing of the bridge.
Q. Can you state it without

looking at your notes? Do you remember what your notes say?
A. I can tell in a few minutes by my notes.

Q. All right you can if you insist on looking at your notes. Do you know the distance from Niles to the mouth of the creek without looking at your notes?

A. No. I would have to measure that on the map. It is about eight miles.

Q. About eight miles from Niles to the mouth of the creek?

A. Yes.

Q. Now give us the grade for that eight miles?

A. at the height of 90 feet above tide, at the first ridge slightly above Niles —

Q. (Int'g.) That is how many miles out?

A. The elevation is 90 feet above tide. I am speaking now from notes of the Western Pacific Railway where I was engineer.
Mr. Cadwalader. That is not

what Judge Wallace asked you. He asked you the grade of that eight miles from Niles to the mouth of the creek?

A. Well, Niles is about the same level. As we go along from the crossing above Niles, say half a mile above Niles, down to Alvarado the fall is 40 feet. The general fall you may say is 10 feet to the mile.

Mr. Wallace. Very well. That is enough. You say it is ten feet to the mile?

Mr. Cadwalader. From half a mile above Niles the general slope of the plane is ten feet to the mile.

Mr. Wallace. That includes Niles? A. That includes Niles. I go above so as to make allowance. 2. And it is about eight miles from Niles to the mile of the creek.

A. No. Eight miles from Niles down to Alvarado.

Cross Examination

of
William J. Lewis.

Mr. Cadwalader I just want to ask you a few questions. Your plan commences about Gambles, does it not and goes down to San Jose?

A. Commences where?

I Commences at Gambles, Commences on San Bruno Creek, does it not, and runs to San Jose: your plan of estimates given yesterday?

A. It was the line of the San Francisco and San Jose Railroad, from San Jose to San Francisco.

I. Does it run to San Francisco?

A. Yes.

I. Does it cross the San Bruno mountains?

A. It crosses the dividing ridge there.

I. That is near the San Bruno range is it not?

A. That is the San Bruno mountains range, that juts out at the Golden Gate.

I. The first creek south of the range is San Bruno creek, is it not?

A. I never heard of a creek named San Bruno creek. It is Lux's creek perhaps.

Q. That railroad was built in 1855, was it not?

A. No. 1863 - 1862 - 3.

Q. Not before that?

A. It was not completed until 1863. It was opened I believe in the latter part of 1863.

Q. The erosion which you have given is for 30 years, is it not?

A. The particulars I have given were generally after the flood of 1862, which changed the face of the of the country down there. The ground was raised; this raised grade I have given you. I have ^{estimated} attempted in my returns the effect after the flood of 1862 but not before. But I made a survey in 1851 and at the crossing at Lux's place it was about the level of tide. I have given you one observation in regard to that. I believe that is the only allusion I have ever made to 1851 except

to Lupertino creek.

2. That part of it- was for 30 years?

A. What part?

2. The part you have just mentioned, at Lux's?

A. At Lux's I have just made a single observation as far as 30 years back. The estimates were made since 1862, stated in my direct testimony.

2. At Lux's it- was for 30 years was it-, or for 20?

A. At Lux's it- was after the freshet of 1862; 20 years now nearly.

2. I am speaking of your estimates?

A. The estimates were made within the last 20 years.

2. Of the erosion for 20 or for 30 years — which?

A. Well, the erosion is taking place within a very few years. You mean the erosion of the hills?

A. No. I mean the erosion the result of which you saw on the railroad.

A. You must recollect I have not said a word about any erosion on the railroad, because it- is

all filling up there. The erosion all comes from the hills.

Q. I understand that. But I am speaking of the effect of the erosion which you saw on the railroad. Is that for 20 or 30 years? That is what I want to get at.

A. Oh, the effect of the erosion is entirely within 20 years and probably, as shown by the testimony within the last five or six years. Mr. Sneath's testimony comes in there.

Q. The greater part of it has occurred within the last five or six years?

A. Yes.

Q. Has that been aggravated by the cultivation of the country?

A. Certainly, because —

Q. (Int'g.) They ~~have~~ practically the previous erosion for 25 years did not amount to much?

A. I suppose not.

Q. What is the size of the drainage area of that basin?

A. Which basin?

Q. The basin in which the San

Jose railroad is located.

A. That will require a large amount of figures.

2. Just give it to me in general figures. Give me the boundaries and then we can calculate.

A. That is what I want to know myself. (Examines map.) The length is 47 miles. I cut off 3 miles for the Mount Diablo summit. Then a considerable portion there is in the ocean. Instead of making that 47 I have to make it 44.

2. Well, call it 44. Then give us the width.

A. I say the length is 44 miles. That is on what I call here the ocean house road, which is the San Pablo road, and there is no drainage comes this way, (pointing.)

The Court. That is the length.

A. Yes.

2. Now, what is the average width to the summit?

A. Suppose eight miles would not

be far out of the way.

Mr. Cadwalader. 44 miles in length by 8 miles in width. That would be approximately 352 square miles?

A. Yes, for the whole drainage south of San Jose.

2. Now, what is the drainage basin of Alameda creek or of the Calaveras Cow Pasture?

A. Alameda creek was very improperly defined because Alameda creek as I have said in my direct evidence is made up of not from Calaveras creek alone but from where Calaveras creek unites with Sanol creek and Sanol creek comes from Livermore valley and is made up of three streams there all coming from the Mount Diablo ridge. Those streams are the Yessajura - 2 (Int'y.) Never mind that. I know about that.

A. But calling it the Calaveras Cow Pasture gives a wrong impression. It is shown cor

-rectly on the map.

2. What is the term used in San Francisco. I know where Sanol creek is myself. Now give us the drainage area of Alameda creek. Tell us whether a thousand, or 700 or 500 square miles?

A. I will give that answer accurately. Just leave that blank.

2. Very well. You can give it to the Reporter, if that will suit you, Judge Wallace.

Mr. Wallace. Certainly.

Mr. Cadwalader. Also give the total of your debris deposit on both sides of the bed in cubic yards.

A. The amounts on both sides of the bed?

Q. Yes.

A. All right I will do that.

2. and state how much it is per year from 1849, 1849 or 1851; it don't make any difference which.

A. Well, within the ~~last~~ limits

of my knowledge, whatever it is?
 Q. Yes. And in this table
 state how many cubic yards
 per square mile it is per
 annum?

Where is this Cupertino creek?

Just tell me generally?

A. That is ten miles south of
 San Jose - or nine.

Q. Where does it head?

A. It heads in the Contra Costa
 range of mountains - you
 might call them the
 Santa Cruz mountains - the
 mountains between Santa
 Clara valley and Santa Cruz
 - that range of mountains.

Q. Where does it empty? In
 the bed?

A. It spreads itself below
 Mountain View. It does not
 come into the bay at all.

Q. Is it a dry creek in sum-
 mer?

A. Yes. Like all those streams.
 All those streams rise in the
 mountains and until they
 come in the Santa Clara

valley they are running streams in the mountains where they originate. ~~Then~~ ^{as soon} as they ever strike the valley or very soon after they sink and they are not running streams in the summer time.

Q. The Mexicans call them arroyos, do they not?

A. "Arroyo" means nothing but a "creek"; "Arroyo seco" is a dry creek.

Q. Where is it that the railroad procures its ballast from this Cupertino creek? At what point on the creek does the railroad go to procure its ballast?

A. They procure the ballast from Cupertino creek, from San Jose to San Francisco creek, for 17 miles and I think beyond. That is near San Francisco.

Q. What grade does this creek have where the railroad company finds its ballast?

A. As I testified there is an

enormous amount of deposit constantly coming down below Mountain View, between that and the railroad. It is from four to six feet deep or just as deep as they want it. And then they keep taking out this ballast to ballast the railroad.

Q It crosses a level plain does it not for ten miles?

A, Which does? The railroad?

Q, This creek?

A, The general descent from Mt. View to the Bay is about the same — about ten feet to the mile.

Q, About seven feet to the mile?

A, about ten feet to the mile is the general average grade there clear through to Santa Clara farm. It is the same at Alameda Creek and at San Jose and at Mountain View. The general descent of the valley is about ten feet to the mile.

Q. To what extent is railroad

ballast found there?

A. It can be found in indefinite quantities.

Very large quantities?

A. Any amount that I require.

Q. Is the railroad between there and San Francisco ballasted with it?

A. The railroad is ballasted.

Do you say there is any amount of it?

A. Yes; sufficient to ballast it any way.

Q. Ballast is gravel is it not?

A. It is gravel.

Q. What are the largest stones that you find where the railroad company takes this ballast?

A. About two or three inches.

But it is generally sand.

Q. Look at such stones as you find there showing.

A. Nothing at all like that.

Nothing at all as large as that.

It is gravel.

Q. Does it look like that in box

No. 2?

A. It is a good

deal finer than this [Taking
some from "Box No. 2." >

2. But you have taken the
biggest-stones in the box?

Look through the contents of that
box and give us your opinion.

A. It is not generally coarser
than that.

2. That is a sample, is it?

[Showing witness a handful
from "Box No. 2." >

A. Yes.

2. That is washed there by the
water of the creek, is it?

A. Yes. It goes down in the
creek and is deposited. It
is no coarser than that.

2. What is the character of
those mountains west of the
railroad, that slope of the Coast
Range? Is it sand or sand-
rock - sand-stones?

A. [No answer.]

2. How high are those mountains
east of the railroad?

Mr. Rhodes. West.

Mr. Cadwalader Yes, west of the
railroad?

A. West; west

is correct. I think from 1400 feet — I think it was 1400 feet on the pass I surveyed between San Jose and Santa Cruz — to 2300 feet above tide in the Santa Cruz range. Of course now I speak of north of Los Gatos creek; because as you go south, you have to include Mount Butte.

2. Then the mountains get higher do they not?
 a. Yes. It is very near 4,000 feet to the top of that.

2. There is a mountain range up to this intersecting mountain range of Mount Bruns, is there not?

a. There is a mountain range which I particularly explained in my direct testimony. The Santa Cruz Range, the Santa Cruz mountains, run out and terminate. They terminate before your coming to Lake Merced, break right off at the ocean, and then

Mount San Bruno is an independent mountain. That juts out and goes to Golden Gate, leaving a space there. Then the space between that is connected by a low sand ridge 150 feet high which the Geological Survey designates as the San Miguel hills, at the Colma station on the road to San Pedro, about nine miles from them.

Q. Is the country there highly cultivated, this watershed?

Is it or is not the whole of it in a high state of cultivation?

A. In the Santa Clara Valley, by which I will designate ^{it}, say, south of Lux's, it is all in a fine state of cultivation.

Are not the hill tops in a state of cultivation?

A. In some places they are.

Q. What is the character of the rock in these mountains?

A. It contains a good deal of lime. In the Santa Cruz

Mountains there is a considerable quantity of lime stone making very rich soil.

Q, How is the sand? Is it not a sand-stone formation?

A. No answer.

Q. West of the Jersey farm are not the hills all through sand?

A. On the Jersey farm the hills are certainly sand, but not the ocean sand which is a kind of black sand. It is sand and clay; it is vegetable mould on the top and then sand and loam mixed, and very light on top. Then as it goes down it gets more and more solid and at last becomes what might be called a sandstone rock, but not of the color of the ocean sand which is of a black color, black sand.

Q. But still it is sand, is it not?

A. Yes.

Q. Very easily eroded, is it not?

A. Very easily indeed.

Q. You know where the Jersey farm is, do you not?

A. I was there. My observations were on the Jersey farm particularly.

Q. The Jersey farm is on the side of the mountain, on the side of the hill is it not?

A. Certainly.

Q. Where the valley commences?

A. It comes right down through the valley; it comes right down to the County road. That I believe is the end of Casey's —

Q. [Int'g.] It is all on about a slope of 25 degrees is it not — the whole of Sneath's farm?

A. That would be rather heavy. It is all on a slope. As soon as ever you come to the County road you begin to go up hill and continue to go up hill. But then there are valleys between.

Q. That is in the Santa Clara Valley is it not?

A. What?

Q. Sneath's farm?

A. Sneath's farm you may

1198x

say comes down to the County road which is located right in the western side of the valley.

Q. How does the drainage area of this San Jose Railroad Country compare with the drainage area of the American River as to the facility of erosion?

A. I do not know because I have never been at the head waters of the American. I am unable to answer that question.

Q. I will ask you about this Coyote Creek, that runs parallel too, don't it?

A. It runs east and west.

Q. How? A. Sand and clay, it runs through the Santa Clara Valley and it has gone clear through Sneath's place.

Q. Does it bring down any quantity of gravel, or immense quantities as you would say?

A. It brings down immense quantities of loam and sand. Yes, as I said in my direct examination. That is the general soil, it runs through the

Santa Clara Valley and it will break generally from year to year. It will break down the land there which is good cultivable land. It is sand and loam but is about as good land as we have in the Valley.

2. Don't it bring down gravel from the mountains that is what I want to know?

A Well, it brings —

2 x Inty? It brings it clear down to San Jose, don't it?

A It don't get to San Jose

2 Where does it come to?

A It goes toward the bay

2 How close to San Jose?

A Well, about 3 miles off

2 Now I want you say

whether it don't bring down immense quantities of gravel?

A Well, the sand and gravel

is certainly deposited below there, but that is sand gravel and clay, and I would rather say that it

Comes from the decomposition
 by the water, or the mud
 that is brought down because
 we are too far off. Now for
 distance from San Jose to where
 the Creek comes down from
 the mountains - Mr Rhodes
 will tell you how far it is -
 but from San Jose to where
 the Creek comes from the
 mountains it is at least
 18 miles

Q Can you cross this Creek
 in any section of the country
 without crossing a gravel
 bed? A The bed of the
 creek.

Q Yes. Just answer that
 question now? A No sir

Q From stem to stem you
 can not cross it at any
 quarter without crossing
 a gravel bed?

A The bed had gravel in it
 undoubtedly

Q It has a great deal of
 gravel in it.

A Gravel and cobble stones

Sometimes.

Q It has layer gravel in it than the Cupertino Creek a much layer.

Q There are cobble stones in it? A Yes.

Q What grade does that creek run upon through the valley. What grade does that creek run on? A I was trying to recollect. I will say that I made a survey of the Railroad from San Jose to Gilroy and of course we followed that valley and followed it up to the Summit.

Q I mean where it runs through the valley where you find these cobble stones?

A It runs through a valley.

Q What is the grade of the Creek?

A. It runs through the valley about 18 miles above San Jose. It is 18 miles further up. That is where Cayote Creek comes in to San Jose Valley, and I

think the grade is about 10 feet to the mile.

Q. So that you have no doubt about the cobble stones travelling in that creek with a grade of about 10 feet to the mile?

A. I know they don't. of course every body knows that. It is the washing out of the original soil, and in the mountains before we get to the San Jose Valley, there is not a cobble stone. There is not a cobble stone in the mountains before it comes to the Cayote. Have you a map of Santa Clara County here? The creek runs I think East of San Jose. It runs north-east and then it turns and goes into the valley and it comes right back again and runs nearly in the opposite direction. I want to make this observation general, that though those mountains there are no cobble stones

or anything like them, because the Mountains are a slate and granite formation.

Q Is not the bed of that Creek paved with cobble stones?

A The Cobble stones are found in the formation of the valley itself.

Q I did not ask you that. Is not the bed of that Creek paved with cobble stones?

A Said handsomely? There are cobble stones I believe all along.

Q Is not the channel of the creek paved with cobble stones?

A I never heard of it being laid with Cobble stones.

Q Paved? A I never heard of anybody paving it.

Q I do ask you in that technical sense?

A There are gravel stones all the way through.

Q For instance, in any direction down in the bed of that Creek, you will find the

Smaller gravel higher up on the banks, and as a wagon gets into the bed it then strikes the cobble stones.

A From the very entrance in San Jose Valley, there are cobble stones all along and sand. Sometimes it is all sand, and sometimes it is gravel stones and sometimes clay.

Q I will ask you if these cobble stones are not 50 feet wide in the bed of the Creek?
A The width across?

Q I ask you if you do not find cobble stones 50 feet wide?
A You do not mean cobble stones 50 feet wide. I will take it as you understand it, the deposit of cobble stones being 50 feet in width. That is what you mean.

Q I used the plural - Cobble stones?
A Yes, I say at the 12 mile house, there

is a cobble stone deposit
for 200 feet wide at least,
in the creek.

Q. In the creek they are
all water washed?

A. Of course, a cobble
stone can not be any-
thing else.

Q. And you find the largest
where there has been the
fastest current?

A. They are about the
same size.

Q. Don't you find the lar-
gest where there is the
heaviest current? A. I never
have investigated that.

Q. Take Guadalupe Creek
is there any gravel in that
creek? A. Not be-

low San Jose I think none.

Q. But above San Jose?

A. Above San Jose - the
creek has the name of
Guadalupe Creek but it
issues from a swamp. It
goes by the name of Guad-
alupe Creek.

Q. Never mind that?

A. But from San Jose down it is a running creek, running water all the way

Q. Is there any gravel in it

A. I suppose not. It is water all the way

Q. Is there any gravel in the bottom? A. I

presume not. I never was down there

Q. Does the Los Gatos - you know where the Los Gatos is?

A. Certainly it comes into San Jose

Q. That comes into San Jose

A. It comes into the Guadalupe I believe within the limits of the town

Q. Does that stream carry gravel?

A. Yes. It carries sand gravel, sand and cobble stones.

Q. Does it bring gravel into the town of San Jose?

A. I think it does. I think it must come - I think it deposits in San Jose during

time of high water up as far
as the Sisters Notre Dame.
Is that right?

Q. The Academy?

A. The Sisters of Notre Dame
- and on the ground up
to the rail road. That
is entirely across the Grad-
alope but there is owing to
the effects of the water wash-
ing down the Los Gatos creek

Q. It is a very common
thing to find coarse sand
and gravel out on the
adjoining lands is it not?
A. Certainly it is

Q. What is the grade of
the Los Gatos in the Valley.

A. Well I have it from
San Jose up to the entrance
^{to} of the Mountains about the
river of Los Gatos

A. That is about 12 miles

A. Yes I should say it was
about. I have to speak
from memory because I can
not give it exactly

Q. Give it to us from

memory? A It is
about the same - About
ten feet to the mile probably
- rather less

Mr Wallace we offer in
evidence a map - a certifi-
fied copy of a map - from
the office of the United States
Engineer of the Bay and Harbor
of San Francisco and the
entrance to it

Mr Cadwalader Do you offer
both of those maps?

Mr Wallace I offer this map
Mr Cadwalader Certified copies
of these maps are not ad-
missible

Mr Wallace They are admis-
sible under the Statute, and
I will state that this is the
Survey of the Harbor of
San Francisco made in the
years 1827 and 1828 by Captain
Beachy of the Royal Navy
and which was returned to
the British authorities and
the Government of the United

State received it from the Naval Office. This chart is certified by Colonel Mendall who is the chief in the Engineering department of the Coast. It is an Archive belonging to the Government. He certifies that this a traced copy. I suppose we might send to San Francisco perhaps and get Colonel Mendall to bring up the original, but that would do no good if there is no defect in this - if it an inaccurately traced copy.

Mr Cadyalady If you will let us have those two maps I will inform you at noon whether I shall object to them. We cannot pass immediately on a document which was made 60 years ago.

Mr Wallace If the gentlemen want to look a thing I will let them have both of the maps. This one comes from the Coast Survey office and

was made by Charles Patterson
and is a map of San Pablo
Bay and is from the office of
the United States Coast Survey
The Board. Do they show
soundings?

Mr Wallace. Yes.

Mr Cadwalader We will look
over them during the noon recess

Mr Wallace This is the plan
Mr Smith was to produce

Mr Cadwalader This chart
has not been approved at
Washington

Mr Hamilton Smith - It has
been approved. It has not
been published or printed but
it has been approved

The following is the table
 presented by William J. Lewis
 after leaving the stand and
 is included as part of his
 testimony by consent of
 Counsel

Amount of debris deposited on West Side of the Bay of San Francisco at points mentioned On Southern Pacific Railroad near San Bruno Station				100.583	cubic yards		
On Luxs Creek				733.333	"	"	
In Luxs Slough				1.815.000	"	"	
				2.648.916	"	"	
From Alameda Creek				3.775.200	"	"	
Total				6.424.116	"	"	

Alameda Creek —

Total water shed				659	Square miles		
In San Jose Valley				72	"	"	
In Mountains				587	"	"	

Testimony
of
George Davidson
Called for dep. sworn

Mr Wilson Q You reside at
San Francisco? A Yes

Q How long have you
been a resident of
that City?

A Almost if the time since
the Spring of 1850

Q What is your profession
and how long have you
pursued it?

A I am Assistant in
the United States Coast
Survey, Coast and Geodetic
Survey and have been in
service since the first
of June 1845

Q Mr Cadwalader What
service? A In the
United States Coast
and Geodetic Survey

Mr Wilson Q What particular
official positions have
you held having relation

to the Coast and Geodetic Survey? and other matters of similar character on this Coast, Professor?

A one of the early duties which devolved upon me was the study of the Harbor formations, deposits along the Coast and in the rivers and the obstructions etc of navigation, the deposits coming from the rivers and so forth. That was my particular duty.

Q On the subject of irrigation did you have some special appointment from the government?

A Having made the subject of drainage and the movement of water and deposit, a specialty for years, I was ordered by the President — I was made one of the United States Commissioners for Irrigation in the

San Joaquin, Sacramento
and Tulare Valleys for
the purpose of advising
a general scheme of
irrigation.

Q. Did you perform your
duties under that appoint-
ment? A. We performed
our duties, we examined
the whole of the Sacra-
mento Valley, the Tulare
and the San Joaquin
Valleys, from Shasta on
the North to San Medio
Cañon on the South.

Q. Did you under the
authority and under the
direction of the Government
visit other Countries
and lands with a view
to informing yourself on
the subject of irrigation
and drainage?

A. The Commissioners of
Irrigation in their Report
stated that the knowledge
that we had of the sub-
ject should be increased.

by the Commission or other persons visiting foreign countries where irrigation had been practiced to a large and commercial extent and for that purpose after my astronomical duties in Japan in 1874 I had instructions to examine such works of irrigation as I saw fit in Japan and China and in India, Egypt and in Italy and other parts of Europe and we performed that duty and officially reported thereon.

What were your duties in Japan that you refer to? A My special duties were to observe the transit of Venus; having been sent out for that purpose under special authority in 1874.

12002

Mr. Adwalade I suggest

that we avoid any
 exploration into astronomy.
Mr Wilson I think that
 remark was entirely un-
 necessary.

The witness I understood
Mr Wilson to ask me what
 was my special duty
 in Japan.

Mr Wilson I did ask
 you that.

Mr Leadwales I am not
 complaining about the
 witness. I am complain-
 ing about Mr Wilson bring-
 ing the transit of Venus
 into this case.

Mr Wilson In connection
 with the State authorities
 or engineers have you
 performed any special
 duty and if so what?

I was also appointed
 one of the United States
 advisory Commission to
 the State Starboard Com-
 mission. I think it was
 called that, having

special reference to the study of the water front and the harbour of San Francisco

Mr. Loewald You may ask the Professor direct questions and I will not object

Mr. Wilson What portions of the Bay of San Francisco or of the Golden Gate have passed under your official observation or examination Professor?

A Principally that part of the Bay of San Francisco adjacent to San Francisco and within view of it you might say including the Golden Gate out to the heads, out as far as the Farallones and up into San Pablo Bay and not very much down into the Southern part of the Bay or in Suisun Bay, altho' I have been through them both

Q What official charts exist in the office of the United States Coast Survey in relation to the bar and the entrance to the Golden Gate?

A All the surveys which were made there from the earliest - I think 1854 are in the office of the Coast Survey at Washington and tracings of many of the originals are in the sub office at San Francisco

Q Are those official charts upon deposit there for the action of the officers here upon those subjects? ~~At where~~

A We are called upon at all times to furnish information upon those charts and I have authority to give that information

Q Are they the basis of constant action by the officers? A Yes

Q What are the oldest maps on record there in reference to the bar or the Golden Gate?
 A I think it was the year 1854, the first. I have the map here and I can correct myself as to the date by reference to the map.

Q Are there maps there of other Engineers than those of the United States on file?
 A Not of the United States unless you referred to those of Wilkes about 1841, but our work which we have specially studied starts from about 1854 and is to 1873, as far as the harbor and bar of San Francisco is concerned and up in later years to San Pablo and Suisun.

Q As to the bar then what are the two surveys that you refer to especially what are the years?

A I think 1854, I am not sure about the year and 1873.

Q Are you acquainted also with a map of the English Admiralty, prepared by Capt. Beuchey of the Royal Navy?

A I studied Beuchey's and other Charts before 1857 because I was then writing a Coast Pilot for the use of the government, relating to the depths of water, especially on the bar and the approaches to the Rivers and I consulted his Chart in relation to the harbor of San Francisco and in relation to the entrance into the Columbia River.

Q This map of Captain Beuchey's purports to have been made in 1827 and 1828?

A I thought it was 1829 but of course my recollection is probably incorrect as it is going back too many years.

Q Is that the oldest chart there is relating to this subject on file in the Coast Survey Office?

A It is not on file in the
Sut Office. It may be on
file in the Washington office
I know that Chart has been
used by the English up to
within a few years.

Q Used by the English Officers
A It was used by the Commander
of Her Majesty's Ship Zealous
An Iron Clad drawing 26 1/2
feet of water.

Q What year was that?
A It was seven or eight
years ago.

Q Is it a map that is reg-
ularly lithographed and pub-
lished?

A Yes by the British Admiralty
Mr Wilson I will exhibit this
map to the witness if there
is no objection to it?

Mr Cadwalader I suppose you
have a right to use it as a
diagram?

Mr Wilson I purports to be
a copy certified by Colonel
Mendall - it is the Beachy
Chart. It is an Archival

The Witness. The appearance of this Chart is similar, the general appearance of this map is similar to the one that I consulted in my early studies, and it was brought prominently to my mind because a British Ship entered with that map and they were unaware of certain Shoals that existed.

Mr Ludwalader Professor I bid you beware of the shoals of hearsay evidence ?

A I am speaking about the Shoals that I know of.

Mr Ludwalader But some times we have shoals in law ?

Mr Wilson He said that the British Admiralty had adopted that map. The Witness The Admiral himself informed me of it and the officer himself brought it ashore and showed it to me and he

showed me his track
Mr Wilson Did he make
a personal application to
you for assistance?

A Yes.

Q Was she a vessel of
unusual draft?

A Yes sir.

Q She came into the
harbor and went out?

A She came into the harbor
she came in twice and went
out twice.

Q By whom was the survey of 1853 made professor?
 A I would like to examine the Chart to see whether it was made in 1854.

Q Have you got a copy of it here?

A Yes sir if you will permit me to examine it (Referring) 1855 the first survey.

Q Was that the date of the publication or the date of the hydrography was finished

A It is endorsed surveyed 1855.

Q You referred to another map I think 1871?

A 1873.

Q Have you got it there

A Yes sir (Producing map) 1873 - the winter of 1873-74

Mr Caldwell What is that second Chart?

A The first survey was 1855

Q That was the Coast survey was it?

A Yes sir.

Mr Wilson Those are both

Coast survey maps the last
you referred to?

A Yes sir.

Mr Eadwalader 1855 and
1874 - 75

A 1855 and the winter of 1873
- 74

Mr Wilson Have you superintend-
ed the work yourself of that bar
A At that time I had the di-
rection of all the details of the
work, instructed the officer
as to where he should establish
his current stations &c and
When the work was brought
in to me examined the details
of his work, made suggestions
as to where the work was to
be filled in if I was not sat-
isfied with the fulness of details.

Q From your knowledge of
that portion of the harbor and
the entrance and from the
official maps has there been
any change in the depth of
water on the bar from the
earliest records to this time?

12092 Mr Eadwalader We object to that

He has not shown a personal knowledge as distinguished from an official knowledge. The official knowledge would have to be established by the Chart if at all?

Mr Wilson We propose to ask him as to the changes which have taken place in the bar as well from his own knowledge as from the official records.

The Court I suppose he can be asked to examine the Charts and tell whether they show any change.

Mr Wilson Examine those Charts then professor if you have not examined them and if you have not examined them examine them please and answer the question
A I examined them as far back as 1874 and I have had recent sections made
Mr Cadwalader The Court will understand our not objecting to that as a mere

Comparison - as original evidence?

The Court I suppose that is all unless he states some personal observation; that would be accepted as his knowledge on the subject.

Mr Wilson Have you examined them since?

A I have examined them since.

Q And you supervised and directed the work at the time it was going on?

A Yes sir.

Q The work was done under your direction and control?

A Under my immediate direction.

Q Now you have examined those maps recently with a view to comparison?

A Yes sir.

Q At the time of making the last coast survey was a part of your object also to ascertain what changes should have occurred?

A Yes sir it is a part of my duty to.

Q Now State then whether there have been any changes at all in the depth of the water on the bar?

A The indication is that there is no change of depth.

Q Have you other reasons besides those of measurement enabling you to say that there have been no changes on the bar and if so what?

A One of the curious features developed in the survey of 1873, and developed on account of the detailed manner in which it was done was the existence of living shells upon certain parts of the bar of San Francisco, ^{echinus} ~~echinus~~ and one other variety of shell fish which must live upon the surface of the bottom: if they were covered over by deposit they would die. Specimens were brought up with the lead and they are marked - the positions where all the ~~echinus~~ ^e ~~echinus~~ and the other living

Shells were marked on the
 O harp.

Q What Causes a bar at
 the entrance of a Harbor
 Or that Harbor especially -
 what is the action of nature
 that produces the bar?

A One of the great Causes of
 the formation of the bar of
 San Francisco is the Movement
 of the Sand along the Southern
 Shore Northward - along the
 Southern Coast line moving
 to the North. That is one of
 the Causes. Another Cause may
 be Material Carried down
 from the waters emptying
 through the Channel way.

Q Describe those tides - the
 actions of the waters there a
 little more on the Ocean
 Coast if you please - is there
 something in the nature of a
 Gulf Stream running down
 from the North?

A Off the Coast line there is
 a great stream running down
 the Coast from the Northward

following the general direction
 of the Coast, but immediately along
 the shore I discovered that there
 was a narrow Eddy Current
 working up to the Northward
 along the whole of the Calif-
 ornia Oregon and Washington
 Territory Coast which showed
 one of its marked effects in
 the manner in which the sou-
 thern points of most of the
 openings of the sea shore were
 formed. The southern points
 being generally of sand and
 the Channel way from the
 streams opening generally to
 the Northward and Westward
 right in the teeth of the
 North west swell and wind.
 In San Francisco part of that
 sand is moved along under
 the surface of the water and
 on account of the surplus
 waters from the drainage of the
 great valley of California,
 those are pressed off shore
 forming an almost semi-
 Circular bar around the entrance

to the Golden Gate, a bar whose Crest is nearly six miles from the entrance to the Golden Gate. If there were no surplus waters coming from drainage into the bay of San Francisco that bar would come closer into the harbor, into the Golden Gate and as the tidal waters and the drainage waters were decreased there would finally be no entrance at all. I matters which flow over the Golden Gates with tides what direction would they take?

A You mean the material
 Q I mean any floating material; say a log or a tree or anything floating out of the harbor what direction would it take?

A Of course its first direction is to shoot over direct over the bar but the final direction of nearly all of the material will be moving to the northward. A certain amount may

go to the south but the general movement on account of this Eddy Current will be to the North.

Q What is the action of the tide coming in and out of the harbor how does it operate in the bar?

A The amount of water going out of the harbor reinforced by the drainage of the great Basin, or the basin in which the fresh water empties, tends upon the ebb tide on account of its superior force, to push and material of that character or push the material that is brought down further into the ocean.

Q That is there is a larger volume of water going out than coming in?

A Yes sir, there is a larger volume going out on account of the drainage than is coming in.

Q About what is the tidal prism coming into the bay

of San Francisco?

A. In round numbers I estimate the basin to be about 400 square miles, over 400 square miles, but in round numbers 400 square miles coming in with an average depth of about $3\frac{1}{2}$ feet - 3.6 I think our tide observations show. That is the average rise and fall of the tide.

Q What is the difference between high and ordinary high tide and low tide in front of the harbor of San Francisco?

A The tides are peculiar on this coast, being what is called, a large high, and a small high, and a large low, and a small low, so that a tide is going out and a tide is coming in may come in as a small tide, and there will then be a slight fall, and then there will be another rise of high water, and finally it

will rush down into the
 Extreme low water. In
 a case like that, then
 you have a large body
 of water acting under a
 given time, whereas in com-
 ing in it took nearly twice
 the time to fill up.

Q. That action then is fa-
 vorable to the cleansing of
 the bar? A. That would
 be favorable to pushing
 the bar further out and
 spreading it, and therefore
 increasing the depth of
 water upon it.

Q. What is the width
 of the channel on the
 bar? A. Well, com-
 pared with other channels
 of other harbors —

Mr. Cadwalader I do not
 think that that is respon-
 sive to the question. Mr.
 Wilson's Enquiry was as
 to the width of the chan-
 nel over the bar?

A. It is all channel,

That vessels can enter over any part of the bar.

Mr. Wilson How does the depth of water there, the space which vessels may occupy there, compare with the Entrance of the Harbor at New York.

Mr. Cadwalader I object to that as immaterial. It is taking us around the world.

The Court. I do not know that it bears upon any question in this case.

Mr. Wilson It would only show the capacity of the bar, and incidentally, what length of time it will take to move it, as compared with the New York bar, but I shall not press it.

2. What official Charts exist in the office of the Coast Survey, relating to the Bay of San Pablo and when made?

12104

A In the Sub-office of San Francisco we have 3 Charts, the tracing of 3 original Charts of San Pablo Bay, one of all San Pablo one of a part, which was a study made to see the deposit in the Channel way, through San Pablo Bay. There is one (referring) a tracing of a chart in 1860, and another tracing of a chart in 1878

Mr Wilson Is there any objection to using the tracings in place of the originals? We want the maps of Official Maps, produced for the purpose of showing the truth of the facts which are contained in them

Mr Cadwalader I did not exactly hear the last answer of the Professor; perhaps I have no objection; what was it you said in regard to those papers?

A The surveys subsequent to first, were made to study whether any changes had occurred in the Channel way through San Pablo Bay

Q. They are study papers are they?
 A. They are accurate surveys and studies can be made from them and have been made from them

Q. They are not official are they?

A. They are, yes sir.

Q. Adopted by the Coast Survey Office?

A. Yes sir they are officially ordered by the Coast Survey, of course adopted by the Survey and transmitted to the Survey

Q. Are they copies of papers

A. These are tracings of the originals sent to Washington, of which copies can be had by you or anybody else

Q. But not tracings of originals but tracings of copies coming from Washington

A. These are tracings of the originals before the originals were sent away

Mr Cadwalader. Will you, Mr Wilson, may be I will find no objection

Mr Wilson Examine those two maps and state from them whether there is a change in the Ships Channel moving through San Pablo Bay between 1855 the date of the earliest and 1879 the date of the last?

A I have examined them quite recently
Q. What do you say in reference to that?

A I say that a vessel can carry the same depth of water over the place designated in the survey that she could in the previous surveys but she would have a narrower channel way

Q. What is the effect during that period of time, what has been the effect upon the Bay of San ^{Pablo} ~~Francisco~~ ^{Trav} ~~ago~~?

A. The effect has been to narrow the channel way but not to decrease the depth on the bar

Q. Vessels of as large a draft
 I understand you can go
 through there now as they
 could in 1855, twenty seven
 years ago? A. Yes sir

Q. Will you state what
 the deepest water of Point
 Barlow is by the earliest
 charts or any charts?

A. It appears to be 33 feet
 in the early chart

Q. That is in the chart of
 1855? A. Thirty

feet in the channel way
 opposite Point Barlow in
 1878-9

Q. One is 1855 and 1863
 and the last is in 1878-9

A. It is three feet less in the
 later survey than it was in
 the former?

Q. Were there ever twelve
 fathoms of water off Point
 Barlow at any time?

A. Not as indicated on
 our charts. There never
 was twelve fathoms as
 indicated on our charts

Mr Cadwalader That is according to the charts?

A. Yes sir that is my answer.

Mr Wilson According to any official information that you have? A No sir never more than 33 feet according to any information we have.

Q. What are the sources from which material in suspension in the water tending to shoal San Pablo Bay would come?

A. What are the sources?

Q. What are the sources from which material held in suspension would come?

A. From streams emptying into Suisun and San Pablo Bays there?

Q. Name a few please around San Pablo Bay, take it over the west? A. Will

they begin at Petaluma

Q. Petaluma Creek?

A. Petaluma creek, Sonoma

crack, Napa Creek, then the small streams that come in between. I think there is the Rinole and another small stream that comes in on the South side of San Pablo Bay.

Q. San Pablo Creek?

A. I think that is its name.

Q. Generally about all the streams that have their outlet through Carquinez Straits?

A. The small streams that have their outlet through Carquinez Straits will bring material which will be deposited in San Pablo Bay, a part of ~~which~~ may be deposited in San Pablo Bay.

Q. Are you acquainted with the Mare Island straits and what has been your means of ascertaining and acquiring knowledge of that locality?

A. I have been somewhat personally acquainted with

Mare Island straits since 1857 and have examined the different surveys that have been made of those straits for the purpose of ascertaining whether any deposit has been made in the straits.

Q. What were the results of your examination?

A. That a certain amount of deposit had taken place on the floor, wherever projections have been carried out into the water as wharves and so forth.

Q. What structures do you refer to?

A. Wharves and even vessels lying moored along side of a wharf, such a thing as a vessel moored there permanently or for a long time would form an obstruction so that there would be a deposit above or below her.

Q. Have they been in the habit of having old hulks there?

A. I think

so I have seen them at times,
I cannot say how steadily
they keep them. though

Q. What has been the ac-
tion of Napa Creek if any
upon the filling up of Mare
Island straits? A. I

think most of the material
came from Napa Creek

Q. What opportunities have
you had for acquiring
information in regard to
Suisun Bay? A. Not so

much as the other Bays. I
only know it as being the
great broad area of water
where the waters of the Sac-
ramento and San Joaquin
rivers discharge as well as
the small streams from the
North and South. Person-
ally I am not particularly
acquainted with it.

Q. What are the streams that
would furnish material
that might be held in
suspension discharging into
Suisun Bay? A. There

are some two or three small streams on the North and South, I think Montezuma Slough is one; on the South side then you have two or three streams coming out from Pacheco Valley draining from the North Flank of Mount Diablo etc

Q. Where is Suisun Creek - is there such a creek emptying into it on the west?

A. Suisun Creek is one yes sir, the Suisun Creek comes down through Gordon Valley and finally empties there

Q. And then also the main river?

A. The two main rivers.

Q. What is the width of the point of entrance of Carquinez Straits - What is the width of Carquinez Straits at the point of connection and Suisun Bay, that is at the upper end, I do not know precisely what technical phrase

you would call it, the entrance, the beginning of Carquinez Straits going south? a. I should have to refer to the maps Mr Cadwalader that I suppose appears by the map?

a. Yes in the map will show by triangulation Mr Wilson generally about what is the width?

a. I should say about half a mile

q. Is it a very narrow entrance compared to the breadth of the Bay above and below the Straits? a. Yes in

q. The Straits of Carquinez are always narrow neck?

a. Along narrow connecting channel between the San Pablo and Suisun Bay, I think about 6 or 7 miles long averaging about a half a mile wide possibly a little more

q. With high lands on a general rule on each side?

a Yes sir

Q. What number of square feet of water in the straits?

A. I measured it lately but not for this case. I should like to mention that, I measured it lately at high water and a cross section was about 209000 square feet, that is my recollection of it.

Mr. Badwalade. Where was that taken?

A. There were two or three cross sections taken in the strait where it was about 3000 or 3100 feet wide. It happened incidentally that I furnished that some time ago on another question.

Mr. Wilson. What do you say in regard to the ship's channel in Suisun Bay as compared with the earlier records?

A It would be difficult for me to to give any positive answer about that. I could only generalize as to the question

Q What is the natural tendency and effect of all the water courses and streams emptying into Suiseun Bay independently of the action of man?

A ~~In~~ Suiseun Bay on account of the character of the Carquinez Straits is really the great settling reservoir for the heavier material that goes down those rivers and that comes down all those streams.

Mr Lealvalade. That is not the question that was asked

Mr Wilson O have you anything further to add?
< Question repeated >

Q. <Cont> The natural tendency and effect of those streams emptying into Suisun Bay independently of the action of man, taking the County in a state of nature, what is the natural tendency of the streams that enter Suisun Bay?

A. That new formations, new land shall be made more rapidly there than in the San Pablo and San Francisco Bays

Q. Owing to the peculiar conformation?

A. I think mainly owing to the conformation of the Carquinez Straits

Q. What is the effect of that narrow entrance?

A. It is a species of throttling the great channel way into the ocean

Q. Does the tide from

the ocean have any effect of holding back the current as it comes back? Naturally when high water takes place it acts as a barrier towards the water coming down.

Does that tend to add to the deposit of matter held in suspension?

Yes sir, as soon as the current is retarded the deposit of matter and material in suspension takes place more rapidly.

Mr. Cadwalader We do not deny that and I do not suppose anyone else would.

Mr. Wilson What acts of man add to the natural effect and tendency of the streams in the matter to which you have just referred?

Mr. Cadwalader I object to that as calling for a

theory on the subject of rivers with which the books are replete with information.

The Court It seems to be a proper subject matter for expert testimony. Go on.

A The Acts of Man will affect it in a variety of ways; by the cultivation of the soil, by denuding of the ~~hills~~ and the land of forest trees, by placing animals and stock to tread up the ground, by artificial means where he is trying to divert waters in any special direction, by mining, and any operations of that character in any way whatever; wherever the soil is changed from its original condition and new material exposed.

Q All of that tends to largely

accelerate the action of nature?

Ayes sir, it presents new and lighter material to the action of water and it accelerates the movement of that flow of water and that material from the land into the watercourses.

Q. What is the result of fires in the forests on the mountain sides?

A In some of the great fires that take place in this County the roots of trees and so forth are destroyed and the soil is reduced to a light character and then is carried very rapidly by the rain into the water courses. That is another of the sources that I should have named

2. Is the Effect of fire much greater here in this dry Country, during the dry season, in the forests as to the depth that it goes into the ground?

Answer. Because there are parts of the Country where the fire will not penetrate at all, and then there are other parts where it will go down 2, 3 and 4 feet and may be more than that. The drier the soil, and bigger the undergrowth and growth of timber, the more intense the fire, and greater the amount of roots destroyed, carrying the fire down below. Where you get into a region where there is excessive undergrowth keeping the Earth saturated, the fire will not prevail at all.

2 Does the action of man render the rocks and Earth more susceptible to the

action of frosts and Changes of weather?

A Naturally where he Exposes it. When the soil is exposed and washed away from the rocks by their inter position, then that rock is immediately subjected to the action of frost which is a great disintegrator amongst rocks.

Q Frost is? A Frost is

Q Is it one of the most powerful agents?

A I should think so.

Q How does the action of man in settlements of a new country compare with his action after civilization in reference to the accumulation of detritus in streams?

Take 50 years in the first settlement of a country and compare it with the second 50 years.

Mr Cadwalader We object to that as calling for an expression of opinion upon matters treated on a Scientific

works, and not necessarily within the knowledge of the witness

Witness I can also speak from personal knowledge, The Court. Proceed

Witness Wherever the Earth Soil is moved the lighter material is carried away by the rains, and the coarser materials are naturally left, so that the action will be very rapid at first, and subsequently the action will be much slower, because it will either take heavier rains to move the heavier material or they are moved in much less quantity and with less rapidity. I think we have no means of giving the exact relation between any so years and any other

2 Can you give any illustration or examples in the State of California of the effect from the natural wash as distinguished from

mining detritus?

A. Do you mean if I know of cases where there is material brought down in regions where there is not great operation of man going on.

2 Where there are no mining operations?

A. After mining operations? Well, if I understand the gist of your question, I would say, the San Diego River with which I have been familiar somewhat since 1851, where in the early days there was certainly little or no operations going on as it was a grazing country. Although it acted spasmodically some seasons being in flood and others dry, yet it brought down an immense amount of material and formed a great deal of connecting line connecting rise between False Bay on the North and San Diego Bay on the South

Sometimes the channel run-
ning into one bay and some-
times into the other. And
even when its channel de-
flected into one bay a sud-
den rise of the river would
force its way through some
break into the other bay.
In the Los Angeles Plain we
have also the effect of
material brought down chang-
ing the directions of rivers
such as the Santa Ana which
changes its course, and also
the San Gabriel, both flowing
into the ocean south of
San Pedro Bay. Then we
have a small example,
but one that I recollect
very well, in Pacheco Valley.
I went through there in
1858 on my duties on the
I think there
was very little of anything
being done then there but
grazing. I have been through
there since and there has
been a very large deposit

taken place there, which I attribute to the cultivation of the soil. I am positive that the filling in has been in places over 6 feet; because the fences were in places covered by the material. And as a matter of information, I was told that even two fences had been covered. But my own eyesight I know there had been more than 6 feet in places deposited.

2. Over how large an area? A I can not remember.

Mr. Cadwalader knows much do you say, what was your quantity? A I am sure there were deposits of over 6 feet there. New Channel ^{beds} ~~canals~~ were cut through there, and one of the large owners consulted me I think in March or April 1880 when I was at Martiney as to how I could

Correct the Channel beds and divert the water away from these lands. We have then the Kern river district which I visited lately, for an example. I visited it as early as 1873 when I suspect there was very little mining. There after an Examination by myself, Colonel Mendell, and General Alexander, are found that the immense amount of detritus that was brought down from the mountains had built a great levee as it were, or great delta in the Kern river district, and changed several times the direction of the channel of the river and in the washings carried ~~material~~ down towards the main drainage line of that valley, throwing that drainage line, ~~a bit~~ farther off to the southward and westward, to the opposite side of the valley

2. What effect did it have on the original forest there / grove of trees?

A. There are trees growing along the line of the water courses. Whenever there is enough space to give sustenance trees, that is, without reference to irrigation. The forests are up in the mountains. But yet, vast forest trees are scattered all over these plains, or over this delta, brought down by the high waters. Part of that material which is brought down in that region on account of the rapid course of the river is very heavy.

I do understand you that the general bed of the stream has been pressed to the westward?

A. The general line of drainage has been pressed to the westward.

Then for other general examples, and examples aside from what I know of

from personal experience. In every river which runs along a comparatively level valley, if that river is subject to overflows and brings down matter in suspension at every overflow of its banks, the heavier material deposits on the edge of the banks and increased the height of them, while the water that flows inland farther, or farther away from the banks, carrying less material and lighter material, spreads it over larger areas. So that some of these great rivers can be said to be run down on a ridge. It is visible; I have examined many cases of sloughs running into the San Joaquin, and on our tour of observation. It is visible through the sloughs that are passing through Yolo County and in the streams there. It has also I think

a fair example in the
 Sacramento itself. It is
 particularly marked in the
 inundation that takes place
 on the Nile which I examined
 for these conditions, because a
 great problem of irrigation
 had been thought of in that
 country. There the deposits
 are the heaviest on the im-
 mediate banks of the stream.
 Those are cases where depos-
 it takes place without the
 action of man, because in
 a river like that, there is
 no cultivation away above
 there at all to supply that
 effect.

2. Coming back again to Cal-
 ifornia have you noticed any
 of these effects upon other
 places here in the State,
 which you now recall. I
 would suggest to you the
 Burri-Burri Ranch?

a In the Burri-Burri-Ranch
 is that depression, is a de-
 pression somewhere near the

12 Mill house, which I
 Suppose I knew a great deal
 better when a young man
 than now through driving through,
 there has been a large deposit
 of detritus brought down since
 the cultivation of the soil.

In the early days when I
 drove through there, there was
 very little sign indeed of
 any washing. Except at the
 mouth near the Puri-Puri
 Ranch

2 That is in San Mateo
 County.

3 That is in San Mateo
 County

Mr. Adwalade, O' that com-
mences in Sneath's farm
does it not?

A I forget the exact
localities. I knew the
localities better as a
young man than I do
now. But I know that

since the early days
when I drove through
there. the deposit has
very largely increased

Mr. Wilson that is ~~along~~ in
a line west from the
point of San Bruno
mountain is it not?

A that is in a line
west from San Bruno
mountain; on the South
West flank of the San
Bruno mountain I should
say

Mr. Adwalade Commencing
in Santa Clara Valley?

A I did not say Santa
Clara Valley.

Mr. Wilson And it is
not in the Santa Clara

valley. It is the dividing line between the two ranches: the Visitation and the Buri-Buri.

At the in portions of the State I have been in say west of Petaluma ~~Creek~~ where I visited occasionally, there year after year I am some what familiar with the washings that take place. Eight or ten miles west of Petaluma amongst the hills, the farmers, wherever they have undertaken to cultivate, in the little narrow deep valleys, the soil, as soon as they have removed the grass they have opened the way then for the rain waters to cut a channel through there so that large gulches of 10 or 15 feet depth and 15 or 20 feet width,

where a few years ago
there was nothing
but grass land all
that material there is
passing through the
water courses and is
making a deposit down
below

Q. Back of Oakland
what has been the effect.

A. I am not familiar
enough with that locality
to specify

Q. Back of Berkeley I
should have said

A. I'm not except that
on those hills I remember
in the great rain of
March and April 1880
where the ground he
came soaked to large
depths, there the hill
sides, acres at a time
would slide out. I

saw the same result
eye the eye on the hills
west of Petaluma and
around Martinez. They

were very marked. Of course that was a month of excessive rains. I think 10 inches fell in the month of April.

Mr. Leadwala What month? A I think the month of March or April 1880.

© April 1880? A March or April.

Mr. Wilson Have you made any observations in regard to Russian River?

A Twenty one or twenty two years ago I was frequently through that Country; had a station on the top of Mt Ross, and was somewhat familiar with it before the access of much cattle. When the cattle came into that Country and tramped down the wild oats etc. and exposed the soil to the action of rain.

which was sometimes very heavy on the mountain top, it would carry away a vast amount of material from the hill sides down through the creeks and into Russian River.

In fact wherever I have been on the Coast I have found the action very rapid wherever the soil has been exposed and, as you referred to cases of fire in any part of the country where fire has denuded the soil. One of the most instructive little instances which comes to my mind is right in near Fort Point on the hillside where for some purpose of improvement two or three years ago they removed the sod the erosion was remarkably rapid of the exposed soil. of course that is on a

Small scale but it is a good illustration.

Q. What opportunity have you had to notice the action and operation of Poota Creek?

A. I visited Poota Creek region and its area of drainage in 1873 and examined it in 1876, on other work; and I have been upon it in 1880 and 1881. From 1876 to 1881 the width of Poota Creek, about 3 or 4 miles west of Davisville, has increased certainly more than one half altho' the depth of the channel is about the same as it was before.

An immense amount of water has been thrown into Poota Creek and without any operation of man forced that material into the basin, the Gulo basin as it is

called, so that when the volume of water reached the lower lands it has forced new channels there

Q Where does it discharge itself? A It discharges itself into the lowlands called the tule grounds of Yolo Basin, lying between the line above the tules on the West and the Sacramento margin on the East

Q Did you state what amount of debris it carries down?

A I could not state the quantity. I have not seen it in full flood. But the amount judging from the erosion there is very great especially since they have opened the country in the various valleys

Q Have you seen Cash Creek and in that

neighborhood?

A I have seen Cash Creek. I am not so familiar with it. I have been on Cash Creek all the way down to Cashville but not beyond it.

What has been its action with reference to change of channels?

A It changes its place of deposit at its mouth, the same as Porta Creek does. I would like to say that in my examination of the Porta Creek margin I had to study particularly whether I could get the end of my base line for a monument in a position where it would be little liable to disturbance. And in examining along in the margin say 3 or 4 miles west of Davisville I found

there several old lines of sloughs which had served to empty the Poona Creek over the low country there before it reached this lower basin of the Valley.

Mr. Caldwell Before this delta reached it I suppose.

Before it got down to what you call this delta. The whole deposit ^{there} ~~was~~ along the margin of the creek, not only as far as I dug down into it, but judging by the cross section, ~~that~~ is deposit of material brought down from above. That deposit being in places 15 or 18 feet deep over a foundation of clay.

Mr. Wilson What opportunities have you had for noticing the characteristics of the Sacramento River?

As I think it was in the
 Spring of 1878 that I came
 to Sacramento to look at
 the overflowed Country and
 then go down by steamer
 to San Francisco in order
 to judge of the engineering
 difficulties that were
 presented ~~as~~ to the leveeing
 and keeping back the
 flood waters ~~and~~ into the
 channels or near the
 channel, the present
 channel of the Sacramento
 River. I had examined
 the River casually as
 one of the United States
 Commissioners in 1873
 up towards its higher
 region near Redding, to
 say nothing of having gone
 up as far as the Shasta
 way. And while I am not
 perfectly familiar with the
 details of it, I know
 something of its general
 characteristics and regi-
 men.

Q What year was that
you say you came down
for the purpose of watching it
1879? A 1878; I

think it was the Spring
of 1878. I came down a
short time after the
height of the flood

Q What ~~proportion~~ proportion
of the waters of the flood
of that time were carried
in the channel of the
river Sacramento? Generally
I mean. I am not speaking
of specific feet. A half
or quarter?

Mr. Caldwell We object
to that except he has
made a measurement

Mr. Wilson I do not ask
for any exact measurement
I cannot tell how much
water is in a bucket per-
haps, when I can tell it
is about half full

The Court I suppose the
witness can give us some
idea of it. go on.

Mr. Badwalader That is what we object to. If a gentleman comes here in 1878 and says his examination was casual we object to his giving measurements.

The Court Proceed
Mr. Badwalader We ~~object~~ accept.

As I ascended the cupola of the Capitol in order to get a personal view of the ^{country} inundated, and I should think the breadth westward from here must have been 6 or 7 miles possibly 8 from Sacramento; so that the Sacramento Channel itself was carrying relatively but a small amount of the water which then existed in the line of drainage of the Sacramento. Of course, as a stream was going with a very

rapid current
whereas the body
in through the
hole lands in
that basin was
not moving so
rapidly, there
might have been in
my judgment from
what I saw, three
times the amount
of water going
down that line of
drainage, through
what some call
the Gold Basin;
three times more
than was going down
the Sacramento

Q Professor, what is the effect of levees near Sacramento and running south upon the waters in times of flood at the City of Sacramento?

A The way they have been constructed and the way they have been built around the Islands they have prevented the waters rapidly reaching Suisun bay, which is -
Mr Caldwell (Interrupting)
 That was not Mr Wilson's question

Mr Wilson I think it is in reply to my question

Mr Caldwell The question is what effect they have had
The Witness I was about to reach that.

Mr Wilson Proceed. I think your answer is perfect

A The leveeing naturally throttles the River its self, keeps it within limited bounds. Where the Islands are leveed they prevent the water which would naturally

go over the banks of the River from finding its way out through those great marshes, so that the water below the Sacramento is prevented from rushing away, and therefore you would have a retardation of the Current above, working its way backward up the River? Q Would that be true whether the levees were broken in places or unbroken?

A Broken levees have a local effect. I think it would have to be almost a universal break to let the River carry out its full volume, because the water that is going through a Crevasse does not necessarily go into the basin that is on the same surface level as the water in the River

Q Have you considered and reflected upon plans of protecting the River by levees?

Mr Caswelder I object to that question it is irrelevant

2064 Mr Wilson Evidence has been

offered here with regard to levees, and I have asked to some extent what has been the effect of this particular system of leveling which has existed. I simply desire to show by the Professor that by a different system of levees a different result would be attained in carrying the waters of the River. That has been drawn from great experience and study on the subject. He has been one of the Commissioners of the United States in connection with this subject of drainage.

The Court The question is however is this of importance to this inquiry.

Mr Wilson Well it tends to show the failure of the system and that they have been doing that which is injurious instead of that which is beneficial.

The Court That you may show, that they have done anything

to obstruct or fill up the River. That is another matter. The defects of the present system can be shown.

Mr Wilson An attempt has been made by the plaintiffs to show that they have been compelled to build levees on account of the mining, that they have been compelled to adopt those means of protection. The object of this evidence would be to show that they have taken the wrong course?

The Court You can show that they have pursued a wrong principle.

Mr Wilson What has been the principle defect of the levee system which has heretofore prevailed, Professor, in this valley.

Mr Caldwell Ask him if he has examined the levees in the valleys.

A I came down on that trip 12066 in order to look at the levees

as they were at that time. I
 Could form a better Judgement
 of them as they were then just
 above the water, the most of them
 and I think they have been
 Constructed -

Mr Cadwalader We claim that
 that is not sufficient - Steam
 boat trip down the River.

Mr Wilson - That goes merely to
 the effect of the evidence and
 not to its admissibility?

Mr Cadwalader Well go ahead.

A I think they have been
 Constructed so near the edge
 of the River that they have
 not offered sufficient Channel
 way for the flood waters
 to reach the lower bays.

And if you ask as I un-
 derstand what change I
 would make in such a system
 as that -

Mr Cadwalader One moment
 I object to the witness going
 into that.

The Court Points out the
 defects in the present levees

And wherein they fail?

A As far as I can Judge they have not been made upon any general plan or system, and ^{no} consideration has been given to the amount of water which is thrown into the River, that is by excluding it from these great areas of marsh land.

Mr Wilson It is taken into too narrow a compass?

A They have simply increased the height of the Channel way without increasing the breadth of the Channel way. They endeavor to keep the Channel within too restricted bounds.

I say there has been not a general system, that is each levee has been for the protection of some particular locality instead of a general system of levees.

Mr Cadwalader I object to that question. It is suggestive and contains something that the witness did not state and

it is leading.

Mr Wilson I understood him to say that, and that is the reason I asked him.

The Court. He said they were too narrow, that they made the channel too narrow.

Mr Wilson What did you say about that?

a I consider that they have not been built as a system which would give the greatest discharge to the river at flood waters. The levees are built on the bank, elevating the height of the banks, but not giving the channel breadth.

I think if they would give it breadth, it would carry a great deal of the flood waters, except extraordinary ones which come down the Sacramento Valley.

I am acquainted with the levee system, which has prevailed with regard to the islands down near Suisun Bay and in Suisun Bay?

A. I only know about the existence of levees, around some of those islands. I have consulted about forming levees around other, small islands, and in general I understand that they have been made to reclaim the lands of those islands, which in high floods were all covered with water.

What would be the proper method to relieve those islands of the water, which accumulates in there?

Mr Cadwalader I object to that question, it is irrelevant.

Mr Wilson I will ask the other question. Do you know whether they have ever resorted to those islands down there, to a system of pumping, or not?

A. I am not aware of any. I understood you to say that the Sacramento River runs upon a ridge, or on an elevation higher than the surrounding country?

Ayes

Mr Cadwalader That has been proven and admitted

Mr Wilson In the visit which you said you made in the employment of the General Government to foreign countries, did you visit the great rivers, and if so what great rivers did you visit.

A I visited the Ganges and some of its large tributaries, the Soane, the Jumna and also one or two of the tributaries of the Indus, especially the Ravee. I visited —

Mr Cadwalader Does the Court regard this as material

The Court. I do not know what it is leading to

Mr Wilson It is a preliminary question

The Witness I also visited the Nile and in Italy, I paid particular attention to the Po, on account of its drainage system, reclamation system and irrigation system, and I was in the Rhine and

on the Danube and on some of their tributaries as they came out of the Alps.

Q What attention did you give to the river Po and its action and characteristics?

A I Examined it up in the vicinity of Turin, and some point below, soon after it came out of the Alps.

Mr Cadwalader You say you Examined it at Turin and below?

A. I Examined it in the vicinity of Turin and at points below where the streams, the torrents, that come out of the Alps and meet it on its left bank. I also went down near the mouth of the Po to C to study the works of reclamation there and the system of diking which they had adopted, and the works that they had made especially to relieve those great areas of swamp land from the water.

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Q Does the Po itself run

upon a natural ridge like the
 Sacramento? A In its
 lower reaches it is above
 the level of the marshes. It
 its lower reaches some of its
 branches are today

I will now state what points
 of resemblance you have ob-
 served if any between the Po
 and its characteristics and
 the Sacramento River.

A. The region of country which
 the Po drains, the course which
 it takes in regard to the moun-
 tain range, the Alps, on its
 north side, correspond very
 largely — indeed very much
 with those of the Sacramento
 flanked on its left bank by
 the Sierra Nevada, and any-
 one in the valley of the Po
 with the mountains in front
 of him, would be at once
 attracted by the similarity of
 the appearance. The character
 of the streams which come
 out of the mountains are
 torrential, and are very much

like many of those streams as they come out of the mountains here. They bring down a very large amount of material from the upper reaches, from their borders. The precipitation of rain is comparatively similar to what we have in this region. The action of frost must be somewhat the same, because they have the snows and frosts as we have them in the higher Sierra here. As a matter of comparison it impressed me as more nearly like the Sacramento basin and area of drainage than any other river that I visited.

I saw the works upon the P. extended to protect the surrounding country, large and expensive? yes, they were, those that I wanted. I went down on the south branch of the P. to S. There were very extensive levees and in some places there

were carriage ways upon them. They are intended of course to guard the Country against inundation, because all that land becomes very valuable indeed, much more so than any land, and in the upper reaches of the river, to prevent the torrential actions of the streams that are coming into it, great trouble is taken to prevent the bank against erosion and to protect the adjacent land against inundation, when the torrents come and overflow their natural banks.

2 How is that done?

That is done by levees, sometimes of one character and sometimes of another, owing to the peculiarities or demands of the locality or of the stream.

2 How is the water running in the Po, in point of muddiness or amount

of debris carried, compared with the Sacramento at the point opposite the City of Sacramento?

A. I have seen the Sacramento here running very muddy indeed, but certainly the Po was carrying as much mud when I saw it, as much material in its lower reaches as the Sacramento at any time when I have seen it. As a matter of information we know that the Po carries down a very large amount of the material as has been determined by the Italian Engineers. The deposits upon the bank of the Gulf of Venice and all its vast areas of marsh land indicate that.

2. Have you given some study and attention to the Mississippi River, Professor?

A. I was particularly attracted to the Mississippi River problem from the investigations of Humphreys and Abbott upon the

river. I have been upon the river myself three or four times from its mouth upward during 1848 and 1849.

2. Mr. Humphreys and Abbott standard authorities on the Mississippi River?

A. I consider them the best authority on the movement of great masses of the water that we have.

Mr. Cadwalader. The only authority I believe?

A. On the Mississippi, yes. There are other authorities, but they are accepted as the standard authority.

Mr. Wilson. How do the Mississippi and Po compare as to the magnitude of the stream, the character of water and the amount of debris carried?

A. The Mississippi carries an immense — I can not give you the figures — but it carries an immense amount, more water than the Po does. I do not recollect the figures even

in the authorities, but it has a very much larger amount of water.

2. How do these rivers compare with the Sacramento in reference to the natural wash?

A. It seemed to me that the Po is the one that would compare more with the Sacramento than with the Mississippi; although I would always take the Mississippi, with the data we have, as the standard of comparison of material carried down by it and of volume: because it drains such an immense area of country under such varying circumstances. But the amount of material, that is carried down from the mountainous part of the river, may be much heavier than the material that reaches the ocean, either in the Po, the Mississippi, the Ganges or any other river.

2. Have you made some figures on that subject, Professor?

1. From the data given by Humphreys I have.

2. Will you be kind enough to state the result?

1. He states the result in his work. That there is brought down by the Mississippi or by its branches and discharged into the Gulf of Mexico 21 billions, 300 thousand millions of cubic feet, that those bring down in volume 1.24 part of sedimentary matter. Then he says there is a certain amount that is pushed along the bottom for which he gives an estimate. The total amount of material carried out by that large body of water into the Gulf of Mexico or into the bayous or places through which crevasses may exist which after the levees are finished would be carried in the gulf is 8,765 millions of cubic feet per annum.

Mr. Cadwalader. That is out of only 1.24 part and flows along the bottom?

Q. That is the matter in suspension and the material pushed along the bottom, as he expresses it.
 2. 1.24 part of the volume of the water?

A. Yes. That is the 1.24 part - that is the amount in suspension. That embraces the amount that is in suspension, that is carried in in suspension and also what is pushed along the bottom and not in suspension. In other words it is the whole material that he gives as reaching the Gulf by the action of the Mississippi waters.

2. It is 1.24 of volume?

A. Yes of the volume. He gives us as the amount brought down 21 billion, 300 thousand million cubic feet. That would give you as 1.24 volume of sediment 7,345 million cubic feet of sediment. Part of the sediment though passes through crevasses, otherwise he said after the levees are all built we would have in addition to

these 7345 millions, 670 million cubic feet, and there is pushed along the bottom 750 millions cubic feet of sediment, giving the total amount of sediment reaching the Gulf of Mexico from the Mississippi River 8765 million.

Mr Cadwalader. That is about $\frac{1}{30}$ of one per cent. The matter travelling, being transported in suspension.

A. Well, I prefer to keep it in the figures that I have given.

Mr Wilson. Proceed now with your answer further as to the comparison of the Sacramento River with the Po and the Mississippi. I understand you are taking that as the basis of your figures?

A. No I understand you to mean, Mr. Wallace, that you want me to make a deduction or a comparison of what the Sacramento would carry down from the comparison of the effects of the Po and the Mis-

- Mississippi?

Q. Yes, by what you know of those. I do not care about its being in exact cubic yards, but a general comparison?

A. I have made a supposition here which is very near the truth, that the waters draining into the Sacramento come from an area of 25 thousand square miles.

Mr. Cadwalader. That is the watershed of the Sacramento?

A. That is the area of drainage of the Sacramento. The area of drainage is given by Humphreys and Abbott as 1244 thousand square miles. Now, if the Sacramento brought down the same amount of material, the same proportion of material which I have given for the Mississippi, you would have a proportion of the area of one to the area of the other, but you would get 174 million 240 thousand cubic feet per year or 6,453

thousand cubic yards for the drainage of the Sacramento area, supposing it to be the denudation of the land carried down by that and by the Mississippi, where but looking at the circumstances of the case and the great action of frosts and the clearing away of the timber and the agricultural lands, etc, and comparing it with the Po, I should feel almost safe in saying, because I think the Po is carrying down nearly ten times the amount that the Mississippi does, we might safely assume that the Sacramento would bring down three times as much as the flood of the Mississippi. If that is the case then —

Mr Cardwiler, Now, you say the Po carries ten times as much as the Mississippi?

A. Some authorities give it as ten times as great.

2. And upon that rule of transportation in the Po the

Sacramento ought to bring down three times six million. A. I did not say anything about the rate of transportation. It was the mere question of the amount as brought down without regard to their rate.

Mr. Cadwalader. I do not mind the rate of transportation. I think I understand you though.

The Witness. I think that my judgment is tolerably clear with regard to saying that it would be three times as much because Everest has given us the discharge of the Ganges as about three times the amount of the discharge of the Mississippi, and yet it comes from a great many miles - six hundred or seven hundred miles through a very broad plain indeed - so far that when you are on the Ganges you do not see the hills on either side of you.

Mr. Cadwalader. Now you are on the Ganges.

A. I am merely bringing in the Ganges because that carries down a larger amount of material than the Mississippi and yet from all its physical peculiarities, it should not bring down as large an amount of material as either the Po or Sacramento.

2. It brings down about half what the Mississippi does?

A Three times I think - Everest gives it, I think, three times

2. You yourself visited the Ganges I understand, and spent some time upon it?

A I visited the Ganges from its mouth to the débouchement from the flanking Himalaya's

2 What is the character of the Ganges? A In certain respects very much like the Mississippi, but when it comes down to strike into the Indian Ocean it has more openings, more channel ways, more delta room so to speak than the Mississippi. From the Hooghly on the west to the East Channel of the Ganges, as it comes into the waters of the Indian Ocean, I think it is about 200 miles, and then you come 30 or 40 miles inland, overland, to the Sunderbunds which is covered in great cyclones

with the water rising over it.

Q The Sunderbund is the local name for what we call the delta? A It is the local name for the over-floored deltas.

Q That is very extensive there at the mouth of the Ganges?

A It is remarkably extensive. The river itself comes as I said before, through a very broad valley, and some very large rivers empty into it, both from the south and from the north, and then from the East we have the Bramahpootra which is really one of the great branches of the Ganges, if it can be considered such, because it empties into the Ganges, 100 miles or more from its mouth - that is, it is so called in the English Official map - The Bramahpootra empties into the Ganges. On some maps I believe the Bramahpootra is marked as emptying itself into

the ocean, and the Ganges
 comes then become a part
 of it. If those figures are
 true - if it is a fair de-
 duction that there is three
 times the amount of material
 than coming down from the
 area of the Sacramento drain-
 age, we should have three times
 the amount that the same
 area comes give in the
 Mississippi, which would
 be about 19,000,000 cubic
 yards, which should be depos-
 ited beyond its mouth.

2 Do you know any instan-
 ces of rivers, where there is
 no mining, filling up their
 beds and changing their Chan-
 nels and if so, state the in-
 stances. A I think the
 history and description of the
 Mississippi shows that it fre-
 quently changes its Channel,
 and it frequently occurs that
 at a great rise there is a
 cut-off established, and those
 cut-offs are used by the —

Mr. Cadwalader (Inty') He asked
you to name the rivers.

A The Mississippi comes
be one, the Nile comes be an-
other, and in our own State
we have the Kern, another,
and the Po comes down by a
half a dozen different chan-
nels

Mr. Wilson And the Danube
changes its channel?

A The Danube has a num-
ber of channels through its
delta; all the great rivers
I know of have channels
through their delta, one may
be the deepest channel at one
time and for some cause or
other, another may become
the deepest channel, just as
in a river, ^{the} channel may be
on one side of the river, and
on the other side at another
time. A case of that kind
is the Columbia River, chang-
ing its channel way. The work
is done beneath the surface;
in the other cases, they are

Cases where the land is above the water.

Q. What do you say about the river Ravee and the Beas in India?

A. Those rivers bring down an immense amount of material. I would speak more particularly of the Ganges where it comes out, and also the Ravee where it comes out of the flanking Himalayas, where the banks themselves in the Ravee are 50 or 60 feet high, where the head works of the great canal is taken out, and those banks are nearly all heavy gravel and boulders; the banks in many places are embedded, for 50 or 60 feet in height with boulders.

Mr. Cadwalader. What were you saying about the banks?

A. The banks above the head works of the Canal, in order to protect them from abrasion in great floods, are revetted with boulders.

Mr. Wilson What is revetted?

Mr. Cadwalader The Court understands

The Court. So on and Explain

A. It is generally used as a military term, for protecting a steep Embankment, either by loading it, laying rods one upon another, giving such a steep slope as to form an almost perpendicular bank and protecting the natural bank from wash. In the cases that I speak of the banks are revetted in the canal Cavour where the erosion is great - the banks are there revetted with cobbles - at the Rance that I spoke of, the works were enormous, and even then in the great flood subsequent to my visit they were carried away. The fanges near Sturduar, the valley of the river within its high banks is about one

mile wide, cut up by numerous channels, sometimes one channel taking the water more than another and in many of the channels, the bottoms are composed more of boulders. Lower down, the boulders cease and gravel takes its place until you come to heavy sand and then fine sand. The same takes place at the headwaters of the River and there the English at Shurduwar make their protection with stone work of various characters to prevent these changes in the river. If their improvements are broken down by floods then they replace them next season by similar works.

What is the effect of the mud and debris as to filling up the Channels?

A Shurduwar Bann The drift of your question, Mr. Wilson.

Q. I will ask you if this great system of waters in India of which you have been speaking is not for irrigation?

A They are deflected from their natural channels for the purposes of irrigation.

Q. Is it upon a grand scale or a little? A The irrigation canals themselves are almost rivers.

Mr. Cadwalader I will admit that the British Government spent £90,000,000 on it and the money has all been lost.

The witness That is not my understanding, that it has been lost - that is not the Report of the Board of Public Works of India.

Mr. Cadwalader I was offering to make an admission that £90,000,000 has been spent by the English Government on works of reclamation and the money had

been lost

Mr Wilson The Reporter will please reduce that to writing and our response so that we do not know whether it is true or not, but we will take it under solemn consideration

Mr Leadwala I will produce the authority if Mr Wilson desires

Mr Wilson Please note that Mr Leadwala's offer to produce the authority is made, and Mr Wilson responds that he will read it with great pleasure when it is produced

Q. Now do those great ditches and artificial works that you speak of, the canals or artificial rivers fill up or become clogged with mud and debris at times?

Ayes sir

Mr Leadwala I object to that. This is an investigation

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into artificial watercourses

The Court I don't know that I see the point of the objection exactly = go on

A I visited several of them with that especial object and made special inquiries and I was fortunate in seeing one of the great canals 180 feet wide on the bottom intended to carry 7 or 8 feet of water it is an artificial river - in the course of correction. That was the Soane one of the tributaries of the Ganges where it comes out from the hills about 60 miles from the Ganges. That had received a large amount of material ~~from~~ held in suspense in the waters of the Soane river; the waters had been turned out of the canal and ~~the~~ great numbers of natives were then removing the material and correcting

the points of erosion in that canal. The Bari-Doal Canal which takes its waters from the Rance River boulders and heavy gravel make their way into the canal itself although the scouring sluices are directly in face of it and the majority, the larger part of the material passing through the scouring sluices would naturally take down the river. The spoil banks are covered with an amount of material taken out from this special river at times when the water is not needed, because all the native inundation canals would in time fill up and become useless.

The Court What is the grade?

A About a foot per mile. The grade in the Juncos River is about 15 inches per mile and even 100

miles from its source it carries a large amount of material in suspension. All the spoil banks of all those canals exhibit material that has been taken out, the deposit. At Okhla ten miles below Delhi on the Jumna the English there are making a canal with a small grade of 6 or 7 inches and have enlarged the entrance for about a mile in order that that might become a species of settling reservoir for the material that came in from the Jumna, and when the water is not needed it is run out and this amount of material is then taken out by the natives and put upon the spoil banks and correct was made if there should be any erosion, altho' they informed me there that the slope of the canal was so small

that there was no erosion, it was constantly depositing. The water, I think, is 4 or 5 feet, the breadth about 70 feet, and the fall about 6 or 7 inches per mile.

Q Have you noticed the tendency to natural wash upon the Rhine, Rhone and Danube and what means are taken to protect the banks and slopes of these rivers from the natural wash?

A Along that part of the Danube down which I went twice in 1875 I examined some of the small streams that ran into the Rhine and into the Danube on the north side of the Alps, and there to prevent waste of the bottom and sides of the banks they are some of them actually paved with stone - coarse masses of stone and the soil is cultivated or grass.

is grown up to the very edge of this pavement

Q I forgot to ask you a question a moment ago upon another subject as to the effect of wharves and so forth built out into the stream, what is the effect of piers and bridges, is it the same as wharves?

A If a bridge is built with a certain number of piers across a river the chances are that there is scouring between the piers and that scoured material is lifted up and carried a short distance down and generally forms somewhat of a barrier to the free flow of the current at a certain distance below the bridge and that in the end helps to keep back the upper waters as much as the actual retardation of the movement of the upper waters

by the piers themselves

Q Does it have any effect whatever on the diversion of the water course?

A Have you known any instance where it has had the effect to actually divert a water course?

A I do not remember

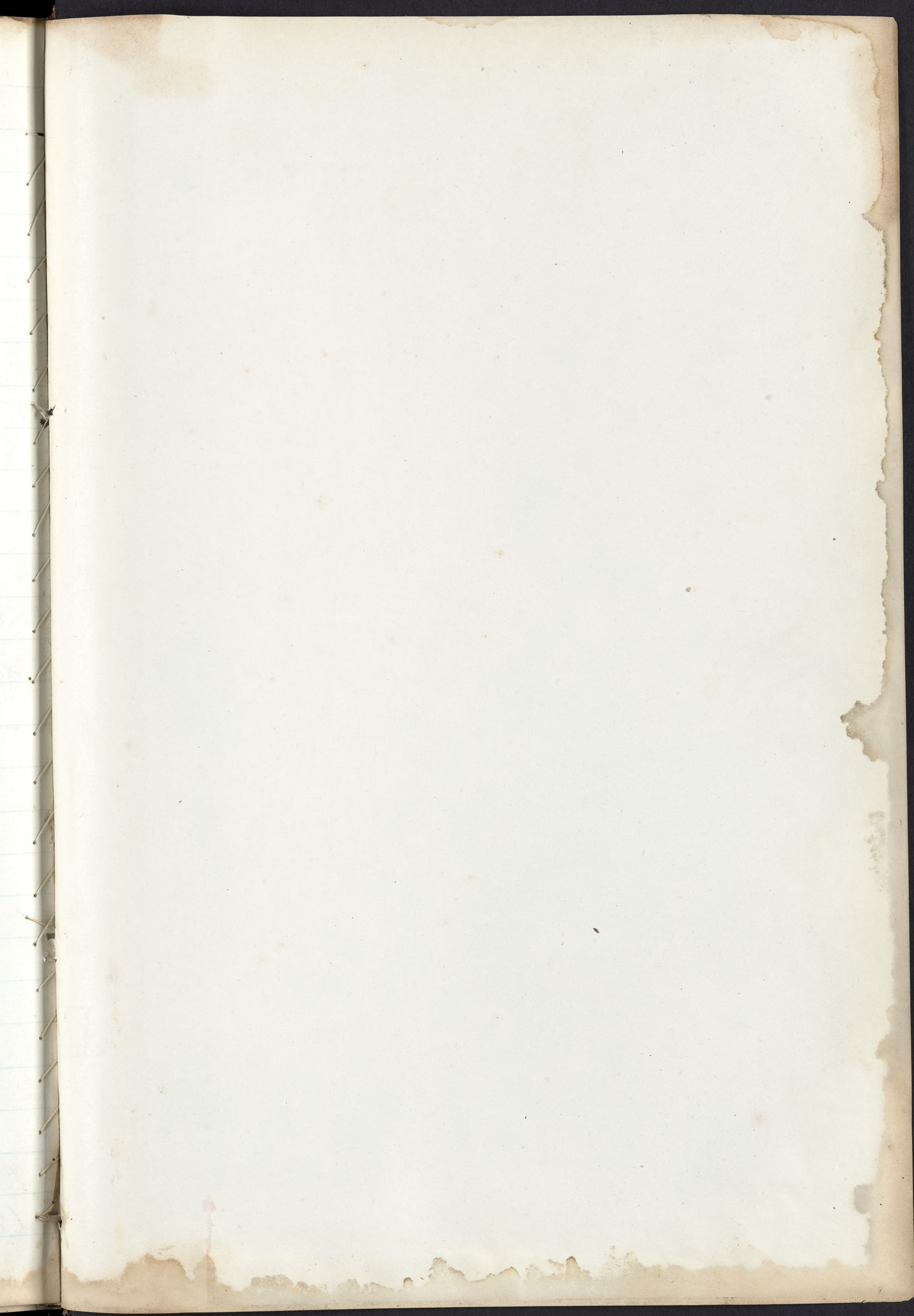
Q For instance in India where there was a diversion of the stream?

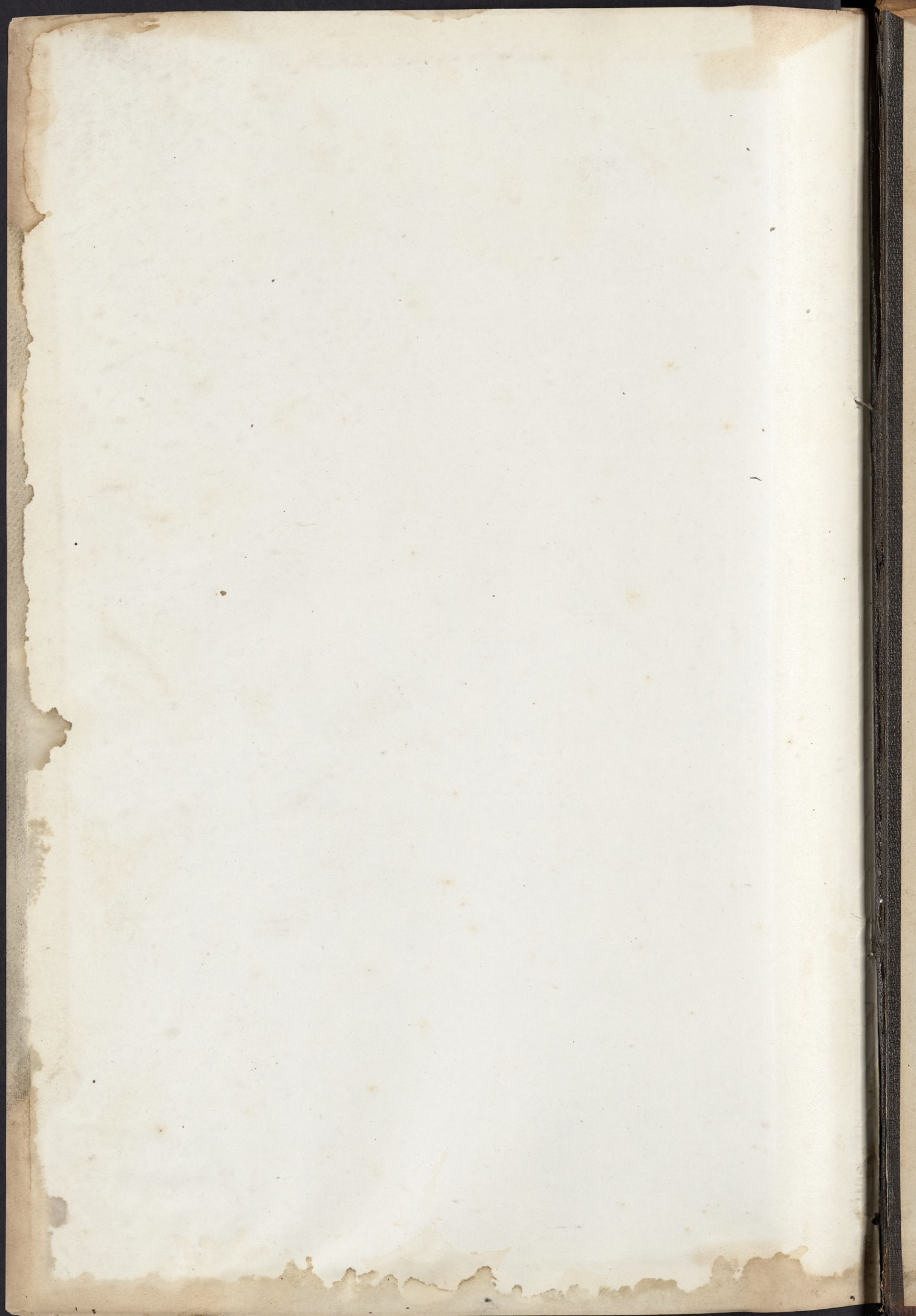
A The officer told me — Mr. Cadwalader I object to that as hearsay Mr. Wilson I did not know but what you had some knowledge of the fact.

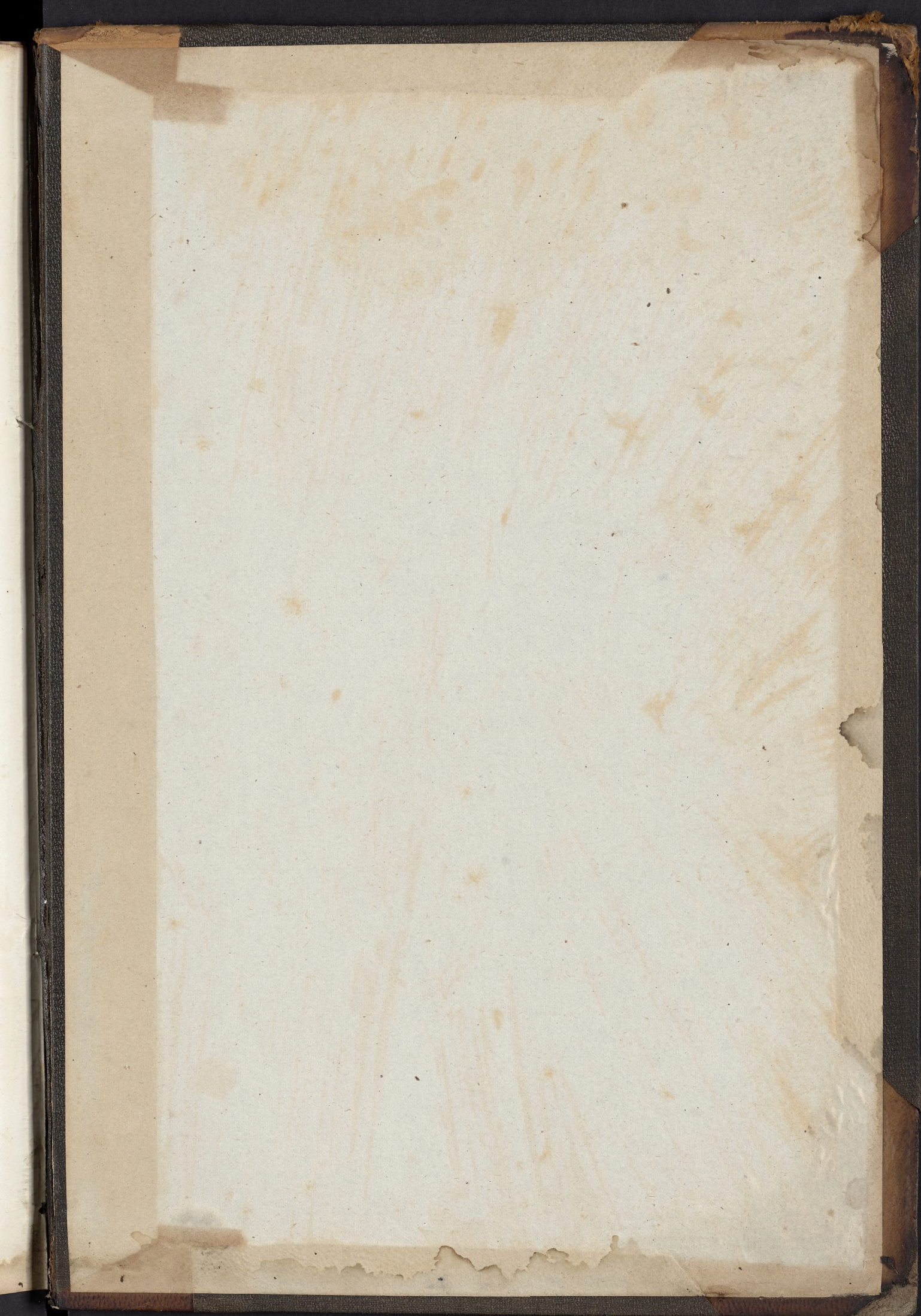
A I do not recall any just now.

Q You have stated the general effect of piers? Ayes.

— " —
< Recess until 2 o'clock >
— " —







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